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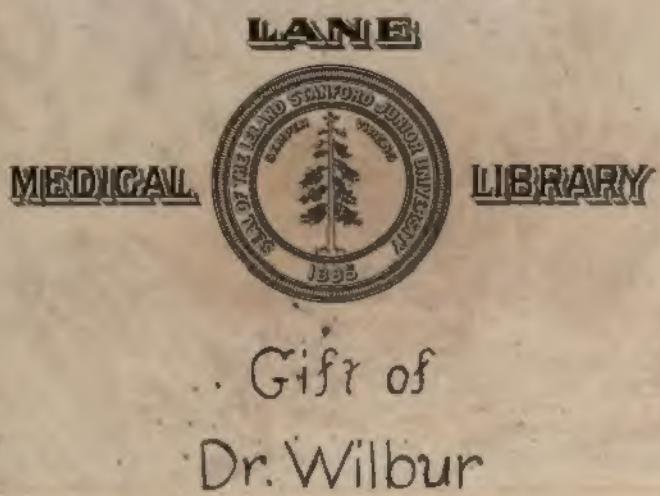
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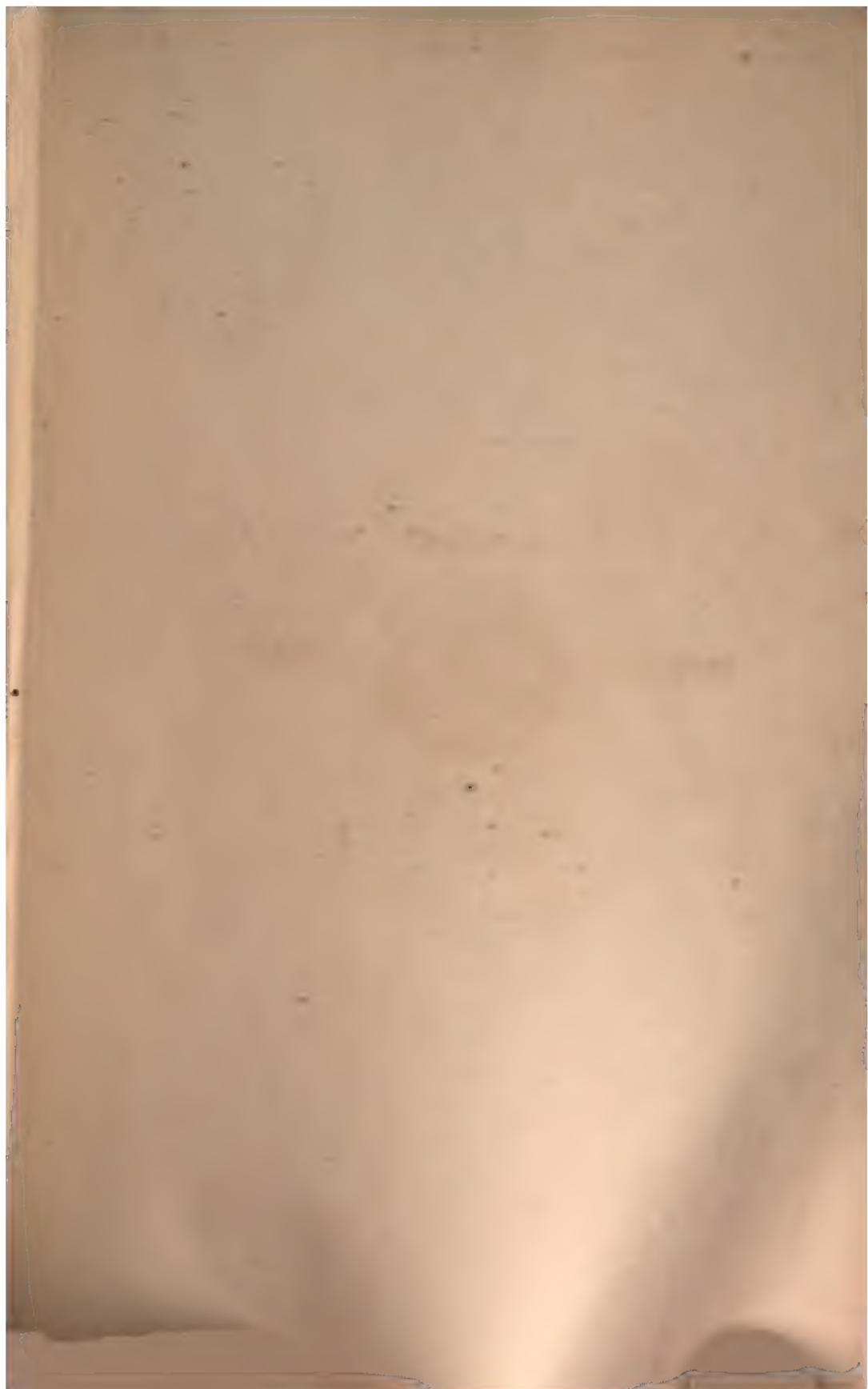
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DISEASES OF THE DIGESTIVE TRACT



DISEASES OF THE DIGESTIVE TRACT

DISEASES
OF THE
DIGESTIVE TRACT
AND
THEIR TREATMENT

BY

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*WITH EIGHTY-FIVE ILLUSTRATIONS, INCLUDING
TEN COLOR PLATES*

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1916

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PREFACE

"Of the making of many books there is no end," was the dictum of Milton, and it is as true now as when written, or else why a preface, which seems an author's justification for launching another book to swell the multitude. His purpose may be one of three—to add something to human knowledge, to put in a pleasing and useful form that which is already known, or to promulgate or defend some pet theory or discovery of his own. My purpose is largely the second: to tell in a clear and not too fulsome fashion the facts pertaining to our branch of internal medicine—the digestive tract—without trying to exhaust any feature of it, whether it be its physiology or pathology, desirable objects, but worthy of a more extensive volume than mine can possibly be. The first object, though incidental, will also be attained in a limited degree, for no one can relate what he has observed in medicine without imparting some information which is not known, at least, to all physicians. While mankind is said to have had the same origin, yet rarely are two members of the human race exactly alike in physiognomy; similarly a disease may present the same general features, but at the same time afford individual differences. It is only by our acquaintance with these departures from the normal course of disease that we become well-rounded authorities, and every book containing any portion of its author's experience with pathological or clinical vagaries must necessarily, when consulted, enlarge our own perspective.

In this work the didactic method is employed from its continued use by the author in class work rather than the deductive—commonly known as case teaching—because the former allows a more complete picture of a disease to be presented, though it must be confessed it is often artificial, and the latter much better "holds the mirror up to nature."

The names of authorities are scantily mentioned in this treatise, since no hope of making an encyclopedia of it has ever occurred to the author—not because he feels under any the less obligations to those authorities for a mine of information, which no one man could have acquired alone in a lifetime. The works of Boas, E. Schuetz,

PREFACE

A. and R. Schmidt, Lefmann, Riegel, Zweig, Wegele, and Hemmeter, as well as the well-filled volumes of the *Archiv für Verdauungs-krankheiten*, have been freely consulted for observations on the rarer diseases which have never come under the eye of the author, and for which they often, in turn, give thanks to the original observer. The wisdom of combining a consideration of the diseases of the stomach with those of the intestines seems fully justified by the intimate association of the two, as well as from the reflex action which one group exerts on the other; we need only mention the gastroduodenal ulcer and the effect of the chronically inflamed appendix on the gastric functions. An attempt has also been made to show the correlation of these diseases with those of other organs—as, for instance, pulmonary tuberculosis, pernicious anemia, and nephritis—lest we be carried away with the idea that disturbances of the digestive functions are always primary ones and we recognize no organs in the body but the digestive tract. An effort has also been made to show that every successful diagnosis rests like a stool upon four legs—history, physical examination, chemical analysis, and radiology—without expressing any great confidence in either one when taken alone. The methods of investigation employed are those in daily use in the author's clinics; there are many others—undoubtedly equally as good, and perhaps even better—but from the multitude these have been chosen for their practical application and ease of accomplishment in a clinic, where, of necessity, methods must differ from those of a research laboratory. The pathology of these diseases has been lightly touched, and then only when there seemed a close connection between the symptoms and the underlying pathologic condition producing them, like that of gastric ulcer and mesenteric embolism, for the purpose was to make this a clinical work. Having during a somewhat busy life passed through many periods of mild intoxication on the part of the medical profession from new discoveries, supposed to outlast time, but now forgotten, many of the newer investigations, not fully established, remain unmentioned; time will ripen them if worthy of credence, and, if doomed to be disappointments, we need not spoil our taste for the perfect fruit. Among these is that of ileal stasis, which seems altogether too common to indicate a true pathologic condition.

Treatment is considered in all its bearings—dietetic, physical, medicinal, and, we may well add, psychic, though as yet we are obliged to coat the pill with the phrase of “change of scene and climate.” In medicinal treatment many of our old remedies are re-

PREFACE

tained, while only the new agencies are mentioned which have been used by the author and found worthy of confidence. On the basis that "figures never lie, but statistics may," but little space, outside of the outcome of surgical operations, is given to the numerical frequency of disease; they more often enable a writer to enumerate some very satisfactory totals in his own practice, but rarely have much value for drawing deductions unless added to those of hundreds of others, so that the final summary shall be something stupendous.

The thanks of the author are due to Dr. A. W. George for his very excellent radiographs which he has allowed him to present in this volume.

A. EVERETT AUSTIN.

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PART I
GENERAL CHARACTERISTICS

DISEASES OF THE DIGESTIVE TRACT

CHAPTER I

SURFACE ANATOMY OF THE STOMACH AND INTESTINES

When we, as clinicians, look upon an abdomen, the true anatomical position of the organs as they appear to the anatomist and the surgeon does not interest us as much as their relative positions upon the abdominal surface as determined by the physical means of examination, palpation, and percussion. Hence it is the surface anatomy which we must ever bear in mind. Based on such groundwork, we find that the lesser curvature escapes our detection in the normally situated stomach, and we are forced to content ourselves with the delineation of the greater curvature, the fundus, and possibly the pylorus, while the other portions remain obscured by their situation under the liver and the heart.

THE STOMACH.

This organ extends from the liver and the left vault of the diaphragm on its upper surface to the duodenum and transverse colon, which form a kind of cushion for it, and in front rests on the abdominal wall. On the left it rests against the spleen, comprising that portion completely under the ribs, which is known as Traube's semi-lunar space. On the right it touches the median border of the gall bladder, which accounts for the frequency with which the pylorus is found adherent to this viscus in cholelithiasis and cholecystitis. Three-fourths of the stomach is found to the left of the median line, while that portion which is found to the right comprises the pylorus and a part of the fundus, while the former is rarely palpable because covered by the liver. The pyloric portion usually makes a sharp bend at the median line and extends to the right, upward and backward, until it reaches the right costal arch. The pylorus lies usually at the level of the seventh or eighth rib, and a line drawn

midway between the left sternal and parasternal lines vertically and one drawn horizontally, midway between the suprasternal notch and the public symphysis, cross directly over the pylorus. This always gives an approximate idea where one should look for the point of tenderness, usually well defined in gastric ulcer if confined to the pylorus.

The cardia can usually be found at the height of the sixth or seventh rib at the left sternal border; as this portion of the stomach is completely covered by the left lobe of the liver, growths at this point can not be felt unless there is marked ptosis of the organ. For practical purposes it is very desirable to know the upper and lower borders of the stomach, which can be determined by intermediate or direct percussion when the organ is moderately distended with gas or on ingestion of the tartaric acid-sodium bicarbonate mixture; in the normal the highest portion, the fundus, can be found in the mid-axillary line at the level of the fifth rib, while the lowest part will be found to correspond with a horizontal line drawn 3 to 4 cm. above the navel.

Attachments of the Stomach.—The upper portion of the fundus is closely attached to the diaphragm and follows its movements, so that the cardia is individually immovable; this immovability is still further enforced by the gastro-hepatic ligament, which extends from the cardia to the right. The pyloric end, on account of close association with the duodenum, which is loosely attached to the side of the spinal column without any firm bands, possesses a fairly large degree of movability, particularly downward, so that prolapses of this part of the stomach, both congenital and acquired, are not uncommon, and in the cadaver it can often be found to have descended almost into the pelvis. From the greater curvature the omentum drops like an apron over the coils of small intestine, turns about, and ascends to the colon, to which it is attached; that portion between the stomach and transverse colon is called the gastro-colic ligament, and is sometimes beset with cancerous nodules when malignant disease of the stomach exists. By overdistention of the stomach the lower portion of the stomach can extend downward until it reaches the pelvis, or even the pubis, in spite of its attachments. The actual position of the stomach with reference to navel, ribs, and liver has been carefully ascertained by Lichtenbelt by percussion, palpation with introduced stomach tube, and x-ray, as shown in a composite picture (Fig. 1).

Position and Form of the Stomach as Determined by X-Ray.—Our views of the shape of the stomach have been very decidedly

changed by examination of the radiograms obtained after the bismuth meal. The normal stomach under these conditions assumes more of a tube shape, lying chiefly to the left of the median line; on standing, the long axis takes a perpendicular direction and in the lying position more of a diagonal. In the prone position the fundus takes a higher level, while the pylorus remains stationary and the air

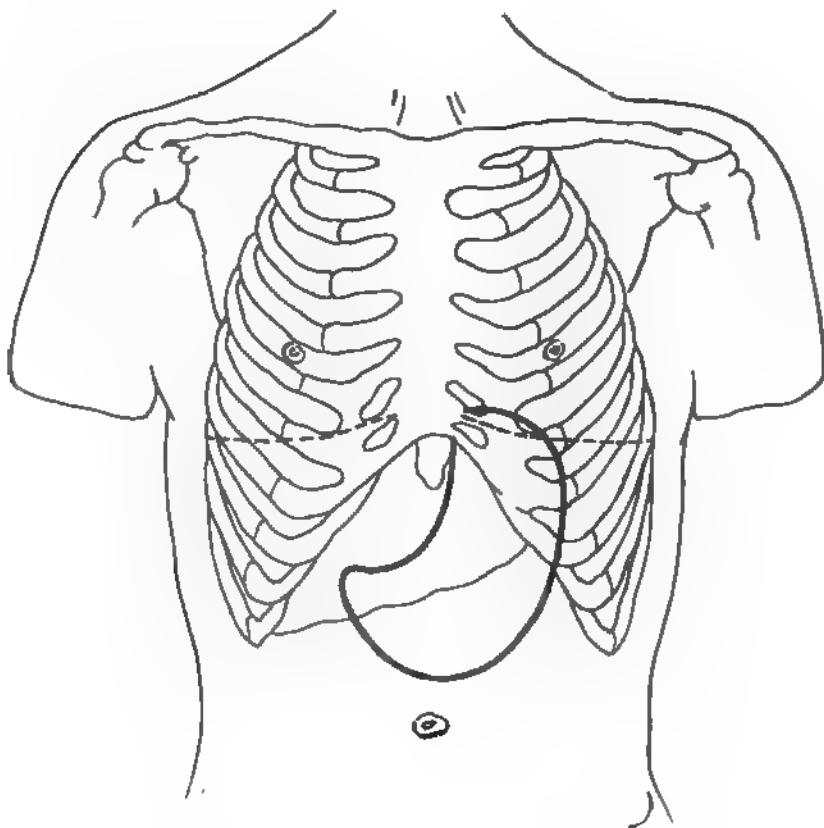


Fig. 1.—Position of the normal stomach determined by palpation, percussion and x-ray.

bubble disappears. The stomach has turned on its axis, which we must consider as extending from the cardia to the pylorus. The change which takes place in the stomach on change of position of the body must be due in a large degree to the weight of the bismuth which drags down the lower pole of the stomach on standing, but fails of this effect when the patient is prone. The greater and lesser

curvatures run nearly parallel downward to, perhaps, four-fifths of its length, when a sharp turn takes place and the remainder of the stomach takes an upward direction, reaching a greater or less elevation, according to the position of the pylorus, which, of course, it reaches. The pylorus, as well as the lesser curvature, are covered by the normal liver. Under abnormal conditions, however, the pylorus



Fig. 2.—Normal stomach "horn form" (From collection of Dr. Atrial W. George.)

may be found under the liver. It is only just to say that Stiller regards this tubelike form of the stomach as a distorted or artificial form produced by the unnatural stimulation of the large amount of bismuth which forces the stomach to a more than physiological contraction, while Hesse, who used bone shavings instead of bismuth, claims that the form of the stomach remains the same as when bis-

muth is used. It is also true that the röntgen pictures of the stomach vary very decidedly according to age, shape of the body (narrow chest), and other peculiarities. In spite of this, however,



Fig. 4.—Normal stomach, "crook form." (From collection of Dr. Atrial W. George.)

two general forms can be usually distinguished—the so-called "horn form" and the shepherd's "crook form," of which the latter is the more common. (Fig. 2, 3.)

THE INTESTINES.

The first portion of the intestine, the duodenum, 25 cm. in length, takes a U-shaped course from the pylorus to the jejunum, lying wholly to the right of the median line, and can be found in the epigastric and upper umbilical portion of the abdomen, a thing which should be borne in mind when seeking the point of tenderness in duodenal ulcer. The first, or upper, part is just behind the costal cartilage of the eighth right rib to the left of the gall bladder; the second portion passes directly downward from the gall bladder in the right midclavicular or parasternal line in front of the kidney to the level of the navel or just short of it; the third part runs obliquely upward to the transpyloric line 2.5 cm. from the median line, where it forms, with the jejunum, the duodeno-jejunal flexure. It should be remembered that the head of the pancreas projects into the curve of the duodenum; that behind the duodenum lie the common bile duct, the right kidney, the portal vein, and the inferior vena cava, while in front of it are the liver, gall bladder, and transverse colon. It is anchored to the posterior abdominal wall, and hence is not movable. These relations are very well shown in Fig. 4.

The jejunum fills the upper umbilical region and parts adjoining to the left, while the ileum is below it and to the right. The coils of the small intestine often lie before the ascending and descending colon. At times, when distended, they may fill the right hypochondrium, encroaching on the region of liver dullness, according to Mayer. The colon, beginning with the cecum, which lies in the right iliac fossa 2.5 cm. below a line extending from the navel to the anterior superior iliac spine, extends upward, forming the ascending portion to the right costal border, where it makes a sharp bend to the left, the hepatic flexure. Before leaving this portion of the colon we must call attention to the appendix, which leaves the cecum 2.5 cm. below the ileocecal valve—i. e., 5 cm. below the middle of the line from the navel to the anterior superior spinous process. From this point it extends to the left in more or less of a drooping curve, with the concavity upward, but normally above the navel to the left costal arch, under which it disappears and here forms a curve upward, backward, and to the left to form the splenic flexure below the spleen and back of the stomach; the splenic flexure is found at a higher level than the hepatic. From this point it extends vertically downward to the iliac crest, forming the descending portion, where, as the sig-

moid flexure, following a more or less crooked course, it makes its way to the rectum, which it reaches opposite the third segment of the sacrum. In connection with the site of the union of the sigmoid and the rectum, it is well to remember that a soft tube can rarely be passed more than 15 cm. into the rectum before it meets with resistance, and, if pushed still farther, it turns on itself and no fluid

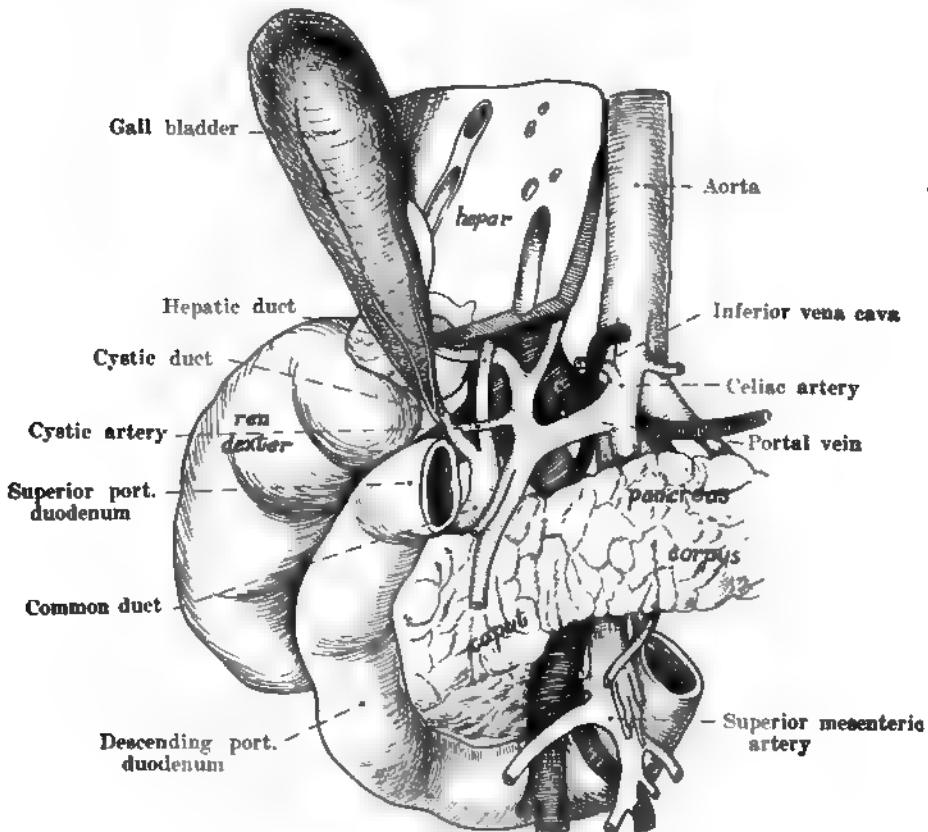


Fig. 4.—Topographical anatomy of the duodenum.

will run through it. The rectoscope, however, can easily be introduced to a depth of 25 cm., but opposite the promontory of the sacrum the sigmoid begins. The relations of the entire colon with reference to the surface of the abdomen are shown in Fig. 5.

This position of the colon, however, is very often departed from; the ascending colon may be shortened congenitally or fail, so that the cecum and the appendix may lie at the edge or even under the

right lobe of the liver, thus sadly confusing the pain of an appendicitis with that of a gall bladder affection. Again, the shortening may act in bringing the hepatic flexure far below the right costal border, so that the direction of the colon from the cecum is almost a diagonal



Fig. 5.—Position of the normal colon

across the abdomen, ascending to the splenic flexure; this is a common form in x-ray pictures, and whether exaggerated by the bismuth can not be stated with certainty. Then, the transverse colon may be so long that a long loop may extend almost to the pubis, or a double loop

or inverted M-shape may be found. This redundancy of colon may be pulled upward, so that it may lie before the liver in the epigastrium or before the stomach in the left hypochondrium. The flexures, too, may be incomplete, and then the two lateral and vertical portions



Fig. 6.—Radiogram of congenitally displaced colon. (From collection of Dr. Arul W. George.)

of the colon converge upward and often form a great loop, which covers the whole anterior surface of the liver. These vagaries of the colon are so often shown by radiograms that they can hardly be regarded as abnormalities and often cause no symptoms, though they

may be associated with functional constipation. Fig. 6 shows one of these many distortions.

Moreover, the sigmoid, when there is a redundant colon, may assume the most fantastic directions, exaggerations of the erratic course of the normal sigmoid, and be found in the middle of the abdomen, covered by small intestine, or extending to the xiphoid or even lying over the liver. Then, again, there may be a fold between the lower end of the sigmoid and the beginning of the rectum, which passes to the right and descends along the cecum to the pelvis minor.

BLOOD AND NERVE SUPPLY OF THE ABDOMINAL ORGANS.

The abdominal aorta runs to the left of the linea alba from the ensiform to the level of the highest part of the iliac crest. At this point the aorta divides into the two common iliac arteries, which then run toward a point midway between the anterior iliac spine and the pubis. The pulsations of the aorta are particularly noticeable when the stomach has undergone a state of ptosis, particularly if it is empty, and often cause marked annoyance to the patient. The right common iliac can also be seen pulsating when the cecum is filled with feces, but I have never noticed the left. The aorta can also be felt in women with lax abdomens under the same conditions—i.e., where gastrophtosis exists. The arteries which ascend to the epithelial cells of the stomach are end arteries, so that their closure by any cause leaves that part of the mucous membrane without nutrition and subject to digestion by the gastric juice, a supposedly common cause of gastric ulcers. One branch of the hepatic artery, the gastro-duodenalis, is of some importance, since it runs along the border between the pylorus and the duodenum and is made much of by surgeons as marking the pyloric ring and differentiating the gastric from the duodenal ulcer. The superior mesenteric artery, after supplying the lower duodenum and the head of the pancreas, sends off sixteen to eighteen branches, the arteriæ jejunales et ileæ, which supply the corresponding parts of these two divisions of the small intestine; each one divides into two branches, which anastomose in the shape of an arch with those lying next. From these arches there spring smaller branches, which act in the same way until three or four rows of these arches follow; the importance of this is that, if an embolus plugs one of the larger branches, a large section of the intestine is deprived of nutriment and complete obstruction may follow, a condition seen once by myself and discovered only at autopsy. The veins of the stomach

empty into the portal vein for the greatest part, so that in cirrhosis of the liver, and other conditions where the portal circulation is impeded, hemorrhage of the stomach is not uncommon. Nor should we lose sight of the fact that the veins of the lower intestinal tract also empty into the portal vein, and thereby sometimes bring infectious matter from the sections involved—purulent appendix, dysentery, etc.—

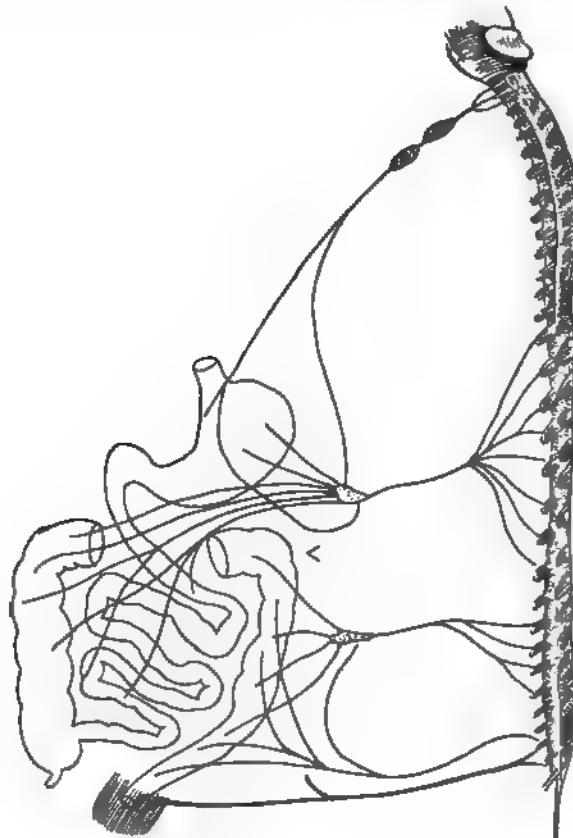


Fig. 7.—Gastrointestinal nerve supply { Celiac plexus.
Superior mesenteric plexus.

which may cause a purulent phlebitis of the portal and consequent thrombosis. The position of the celiac plexus, on a horizontal line joining the cartilages of the ninth ribs and a little to the right of the median line, has a marked significance because here is often found the epigastric tender spot, whether due to an ulcer or to so-called nervous dyspepsia. The site of the plexus mesentericus superior,

at or near the point of bifurcation of the aorta, must also be borne in mind, since it represents often a point of tenderness to pressure, which may mean either the supersensitiveness due to a nervous disorder, or a hyperesthesia due, by means of reflex action, to some organic disease of the abdomen. There is also in the left iliac region a plexus, the mesentericus, which has the same relative position on the left as McBurney's point has on the right, and which marks a common point of tenderness. The McBurney's point itself is no other than a plexus, the ileocolic, lying in the angle between the ileum and the colon, and tenderness over this plexus does not invariably mean inflammation of the appendix, as has been so generally supposed. It is of the greatest diagnostic importance to remember that, by means of radiation, pain or tenderness at one plexus may be felt at another; for instance, in a true appendicitis, pain may be felt at the navel (mesentericus superior) or at the epigastrium (celiac), and that, on pressure over the ileocolic, tenderness will be found at this point as well as at the distant points, and sometimes more extensively at the distant points. The reverse is also true, and tenderness over the celiac due to gastric ulcer may be felt at McBurney's point; only in this way can we account for the frequent removal of the appendix without relief of the pain and the later discovery of a chronic gastric ulcer. The natural reason for this transference of tenderness from the actual point of irritation to a distant one is the abundant anastomoses existing between the various plexuses of the abdomen. When we remember, too, that the *vagus* sends out two branches, one to the stomach and the other through the celiac plexus to the intestines, we can see why an atonic stomach is so often associated with atonic intestines, and why disturbed intestinal functions (constipation) may by reflex action play an important part in the secretory action of the stomach. This correlation of the nerve supply of the abdominal digestive tract can be readily seen from the illustration of gastrointestinal innervation, according to Mueller (Fig. 7).

CHAPTER II

THE PHYSIOLOGY OF DIGESTION

Digestion falls naturally into three divisions—oral, gastric, and intestinal—and, in spite of the fact that vicarious participation enables one organ to do the work of the other, long experience soon teaches that only perfect digestion can exist when each process is completely carried out. It may be true as Cabot states, that he has seen entire absence of gastric symptoms in an individual whose mouth is free from teeth, or, as von Noorden claims, that metabolism remains the same whether hydrochloric acid is present in the stomach or not, yet imperfect mastication throws an extra burden on the stomach, and insufficient gastric juice a similar one on the duodenum, and in few persons can this continue indefinitely without rebellion on the part of the overburdened organs, with untoward symptoms. The proof of this fact also rests on the results of correction of these deficiencies; senile dyspepsia, so-called, disappears when a well-fitting set of teeth is inserted and food thoroughly masticated, and diarrhea ceases when the lacking hydrochloric acid of the stomach is partially replaced by its use in medication; whether it acts in stimulating the natural secretion of the stomach, or in causing a greater flow of pancreatic juice, is not fully clear, but at least the connective tissue and meat fibers, the former supposed to be digested only by the gastric juice, no longer form a part of the discharges as before.

ORAL DIGESTION.

In the mouth, of course, if ordinary care be taken to masticate the food, without haste and without the introduction of extraneous fluid (tea, coffee, water, etc.), with each mouthful, the food becomes finely divided, mixed with the saliva and rendered suitable for the future action of the gastric juice. But a still more important act is accomplished, for, if the food possess a pleasing and acceptable flavor, by reflex action the gastric juice begins to flow; this has been demonstrated so often in humans with a double esophageal and gastric fistula, by which all the food taken passes out of the former, that

there can be no question of its accuracy. This shows the importance of the proper cooking and seasoning of food, as well as the drawbacks to the usual test breakfast (bread and water), of which patients complain as being unpalatable and allude to it as state's prison fare. It has been found that by the process of mastication not only is the food to the extent of one-fourth to one-third divided into fragments less than 1 mm. in diameter, but one-third of bread and potato is rendered fluid, in which, of course, the saccharification of the saliva plays a part. The food, thus prepared by chewing, is forced into the stomach in individual portions by the complicated act of the muscles of the pharynx and esophagus; the reflex, governing this act, is the contact of the food with the posterior wall of the pharynx and roots of the tongue. The saliva, a tenacious, alkaline fluid, contains, as its most active ingredient, ptyalin—or animal diastase, as it is sometimes called—which does not differ, as far as physiological action goes, from the amylopsin of the pancreatic juice. The saliva has a further peculiarity—that, though itself swarming with bacteria, it allows few to be cultivated from it, and also has the power of destroying certain bacterial poisons. As is well known, the action of the ptyalin is to convert the starch by degrees through amidulin, which gives a blue color with iodine, to erythrodextrin, which gives a violet to mahogany brown with the same reagent, then to achroodextrin, which gives no color with iodine; then maltose, which gives prompt reduction with Fehling's solution, is formed, and finally dextrose, the final product of ptyalin digestion. The act of swallowing consists of two varieties of action; first, when fluids are taken, by the muscular action of the muscles of the mouth, especially of the mylohyoid, the mouthful of fluid is forced downward to just in front of the cardia in less than a second's time; second, when solids are taken, each mouthful is driven, by a progressive peristalsis of the constrictors of the pharynx and the muscles of the esophagus, slowly downward to the cardia, requiring in man from eight to twelve seconds for the act. Here before the cardia there is a short delay, especially if fluid is taken in sips, and solids are almost invariably delayed even to a minute's time before the cardia opens. Fluids which are ice cold or contain carbonic acid often cause a closure of the cardia, which only slowly relaxes. Furthermore, the esophagus enters the stomach at a right angle to its surface, forming a kind of valve, so that, when the stomach is full or under tension, it prevents the return of solids, fluids, or gases from the stomach. When liquids are forced to the cardia by the compression of the oral muscles, there is a subsequent peristaltic action on

the part of the esophagus, which forces downward any drops or small fragments which may cling to its walls. This double act of swallowing gives rise to a double sound in the normal individual, which is best heard with a stethoscope over the cardia in the xiphoid region; the first sound is heard directly after the act of swallowing, but is not always constant; the second sound is heard some seconds after the beginning of the act of swallowing, which is practically always heard.

Different individuals react very differently as to the secretion of saliva when the stomach tube is introduced to withdraw the gastric contents; in some there is a flood of secretion from the mouth, consisting chiefly of mucus, which, when the amount of gastric content is small, must play a very important part in reducing the acidity due to free hydrochloric acid, on account of the avidity with which these combine; in others there is little or no secretion of saliva. Chase has devised a very ingenious funnel or ring which goes over the tube and prevents the saliva from entering the receptacle placed to receive the gastric contents.

It must also be borne in mind that, in the saliva and, from its being swallowed, in the stomach contents and feces, there are long bacilli or leptotheix which come from incrustations on the teeth and which resemble very closely the lactic acid bacilli; a point of distinction is the fact that the former, when Lugol's solution is added are stained violet, while the latter undergo no change in color.

DIGESTION IN THE STOMACH.

As soon as the food enters the stomach, it begins to undergo the most thorough chemical changes, by which its identity becomes largely destroyed through the activity of hydrochloric acid, pepsin, rennin, and the more recently discovered fat-splitting ferment which, many still think, comes through the pylorus from the duodenum. But before we proceed to the consideration of the secretion of these chemical agencies and the factors which influence them, as well as the changes taking place in the food, we must acquire an understanding of the divisions and motions of the stomach. This organ consists of two portions, which are anatomically and functionally distinct—the fundus, or main stomach, and the antrum, where the greater part of the digestion takes place. The large stomach, if we may call it such after the manner of herbivora, enables mankind to partake of large portions of food, and, acting as a reservoir, allows small portions to be passed into the antrum, where after hours, perhaps, they are digested

and partially absorbed. The muscles of this former part of the organ are weak, have no power to produce peristaltic action, and simply in the normal individual keep up a tension on the contained food, varying with the amount of food present; if there is no food, in a state of fasting the stomach is collapsed like a bag and the inner walls lie in contact with each other. Whenever food is taken, the muscles contract only sufficiently to keep up a moderate pressure on the content equal to only 6-8 cm. of water, but, when this is acquired, remain quiescent. Thus in the fundus the food rests in layers exactly in the order in which it was eaten.

In the antrum, however, affairs are different. This portion of the organ, when the stomach is moderately filled, as shown by the radiograms, points upward and the pylorus forms its highest point, and therefore it is very improbable that the viscus is emptied by gravity, but by the strong muscular action of the antrum; hence this is provided with powerful muscles, which terminate in a strong ring, the pylorus. This motion consists of peristaltic waves, which begin at the border of these two portions of the stomach, at once or within a few minutes after the food is taken, continue with the greatest regularity, pass toward the pylorus, and end only when the last fragment of food has passed into the intestine. This peristalsis is so powerful that the pressure is vastly increased over that of the fundus and deep furrows are formed, the first of which at a beginning wave may be so deep that a complete separation of the two parts of the stomach takes place. The result of these forcible contractions is that the fluid spurts through the pylorus into the duodenum and can often be heard with a stethoscope over that part; hence the functions of the stomach may be said to be made up of the low, but steady, pressure of the fundus, the peristalsis of the antrum, and the synchronous secretion of the gastric juice. Thus we may explain the continuance of salivary digestion for two hours or more after the food enters the stomach, since the interior of the content of the fundus does not come in contact with the secreting gastric walls, and a free hydrochloric acid reaction may disappear in a gastric content when allowed to stand, for only in this receptacle has complete mixing taken place. It is clear that only small fractions can be subjected to the full action of the gastric juice at a time and in the midst of an active digestion; while the content of the antrum may be acid, that of the interior of the fundus may be neutral or even alkaline.

When, however, any of the food is fully liquefied and digested, it is forced through the open pylorus into the duodenum; solid and un-

digested portions meet an unyielding exit, and remain to be still further kneaded and mixed with the gastric juice. Thus the pylorus has the power of selection, and allows only those portions which are thoroughly digested to pass through. Further than this, the duodenum also has a control over the opening of the pylorus; when the small intestine is empty, the pylorus remains open, which explains the ease with which bile-stained contents may be washed from the fasting stomach and why the Einhorn aspiration duodenal catheter passes so readily through the pylorus. But chemical influences also regulate this mechanism; when fat or acid, such as the acid gastric juice, comes in contact with the mucous membrane of the duodenum, the pylorus closes for a longer or shorter period, dependent on the amount. Another curious circumstance is the fact that, if the stomach is full of food and a glass of water is taken, this runs along the lesser curvature from cardia to pylorus without in any way mixing with the food in the fundus; at first it is mixed with that in the antrum to a certain extent, but soon almost pure water passes through the exit. A dilution of the solid food in the stomach does not, then, take place when water is drunk with the meal, and the regulation of the opening and closing goes on just the same, whether fluids are taken with the meal or not. This pyloric reflex plays a very important part in our digestion; we have yet no measure of the digestibility of food. Fats, we know, leave the stomach very slowly, and we also know that food finely divided is mixed with the gastric juice more readily and quickly and passes sooner into the duodenum than coarser food; but is this always a desideratum? In this way food improperly digested may reach the intestine and thereby throw an extra burden upon it. Our sense of gastric discomfort is very acute, but we know nothing of duodenal indigestion, except by its results. On the other hand, when the digestion, peristalsis, or absorption in the duodenum is delayed or impaired, it may cause a prolonged closure of the pylorus and thereby produce stasis and decomposition, or too prolonged secretion of gastric juice in an otherwise healthy stomach. Boldyreff, too, has observed that, if an individual take a large portion (300 c.c.) of a liquid fat like olive oil, the pylorus opens, allowing the duodenal contents to recede into the stomach. This peristaltic action of the antrum plays a very important part in the act of vomiting. At first the muscular tone of the fundus relaxes, leaving its walls flabby; the cardia opens and the waves of the antrum continue, but against a closed pylorus and a relaxed fundus, in which way contents of the stomach, perhaps aided by the pressure of the dia-

phragm and the abdominal walls, with mouth open, posterior nares and glottis closed, as in swallowing, are forced out of the mouth. The center of all these coordinated acts is in the medulla.

The peristaltic waves of the antrum are also, to a certain extent, subject to our sensations. When the stomach is under observation with the fluorescent screen and the x-rays, it is found that any unfavorable influence, like worry or grief, causes a cessation of these waves and their continuance takes place only when the mind is restored to its normal calm. We have long known that psychic influences may cause a marked change in the secretory functions of the stomach, but here is marked proof that they also act on its motility, and efforts to establish a correct mental status is fully as legitimate in the treatment of functional dyspepsias as selecting the proper medicament, and often greatly more effective. As to the rapidity with which different varieties of food leave the stomach, it may be stated as a general principle, with some qualifications in particular cases, that the carbohydrates, farinaceous foods, and vegetables, which arouse the secretion of but little gastric juice, leave the organ very promptly; that meat remains much longer, especially when, as is customary, it contains fat, while pure fat, and especially the firmer fats, like tallow and lard, remain the longest. Another element is injected into the slow departure of fats, and that is the delayed secretion of gastric juice and the slowing of the liquefaction of the solid parts of the food; both these factors can be used in the diet of those suffering from impaired motility of the stomach and hypersecretion.

We have already spoken of the excitation of the flow of gastric juice by means of mastication and the sense of gratified taste, but this is not the only means by which this secretion may be aroused; even the sight or odor of food causes a flow, but weariness and lack of appetite retard the flow. Then, again, the amount, but according to Bickel not the composition, of the gastric juice varies with the character of the food or beverage. Water induces the production of a small amount of juice, milk still more, next in the series comes bread, and meat demands and produces the greatest flow of all; this is true of meat for any period, but bread and milk change their relative places after the first hour, so that for the entire period of digestion the amount produced by bread is less by one-half than the amount produced by milk. When liquid food is introduced directly into the stomach through a tube, no secretion is aroused, but, if beef extract is brought in contact with the walls of the antrum, a lively secretion in the fundus of the stomach takes place; this is sup-

posed to be due to the absorption by which, in its passage through the walls, a hormone is released or formed which excites the flow through the blood. As fat retards peristalsis of the stomach, so it diminishes secretion, and thus justifies the use of yolk of egg and cream in cases of hypersecretion just as the beef extract has a rational basis for its use in achylia. The amount of gastric juice secreted daily reaches 1,500 c.c., which is of great interest to us when in cases of achylia we attempt by the use of hydrochloric acid and pepsin to replace it; this, as can be seen at a glance, is a Sisyphus' task, best honored by its avoidance. Pure gastric juice, which we never find clinically, but which Umber and Bickel have obtained from humans with a double fistula in the esophagus and stomach, contains hydrochloric acid to the amount of 0.46 to 0.58 per cent, an amount much greater than we have previously believed possible, but the smaller limit of 0.35 per cent has been dependent on the neutralizing influence of the saliva which has been swallowed, as well as by the mucus of the stomach and the diluting effect of both these and food remnants. We have heard endless discussions of hyperchlohydria and hypochlohydria, but from careful experiments it is pretty fully established that the concentration of the mineral acid in the secretion remains the same under all conditions, and what we are dealing with is a hyper or hyposecretion of gastric juice. We may never hope to obtain a juice with this high acidity clinically for the following reasons: a diminished secretion, with the usual albumin containing test breakfast, diminishes the relative acidity, or a greater amount of mucus may be secreted by the stomach, producing the same result, or an increased secretion of the alkaline pyloric secretion has the same effect.

Another function of the hydrochloric acid, in addition to the digestive action, is to check the growth of bacteria; whether it can destroy these microorganisms after they have once entered the stomach seems to be still lacking proof, and that the acid can exert any influence in the intestine, as some claim, is negatived by the utter lack of correspondence between the amount of indol, a product of intestinal bacteria in the feces, with the presence or absence of this acid in the stomach. This acid undoubtedly prevents the fermentation and putrefaction of food which would inevitably take place, if the reaction were alkaline, during its long stay in the stomach, aided by the comparative sterility of all foods due largely to cooking. With a hydrochloric acid concentration of less than 0.08 per cent the action of the lactic acid bacillus on sugar is distinctly stayed, and with one of less than 0.02 per cent decidedly delayed. Now, these acidities may

be found on the outer layer of the food in the fundus and also in the antrum, but in the center of the mass of food, as stated, the reaction may be alkaline, and, since the gastric juice does not penetrate it, the probable reason why in this locality no more active growth of bacteria takes place is the short delay of the food in the stomach. Even when there is a marked growth of these minute objects, it is usually of the fermentative kind and not of the putrefactive; in fact, the former are prohibitive of the latter, and it is curious in marked gastric stasis to see sarcinæ, which act on protein, flourish as long as hydrochloric acid exists, but disappear as soon as lactic acid replaces it. We have already mentioned the pyloric secretion of the stomach as affecting the general acidity of the gastric juice; this contains no acid, but much mucus, is alkaline, and its secretion seems to be continuous, but amounts to only a few cubic centimeters per hour. Much importance has been ascribed to this secretion on account of its influence in neutralizing overacid gastric contents, and, in fact, it does seem to flow more rapidly when the fundus secretion with its acid content comes in contact with the antrum. In the antrum, too, some absorption takes place, which is limited to salts, sugar, and peptones dissolved in water, but not water itself, unassociated with these substances. Other functions of the hydrochloric acid are to activate the pepsin, which is first secreted in an inactive form, to split the cane sugar into grape sugar and fruit sugar, in which forms alone they can be utilized, and to stimulate the secretion of the pancreatic juice; in fact, so important is the last function that, when we have an achylia gastrica (lack of gastric secretion), we are very apt to have also an impairment of the pancreatic secretion, a veritable achylia pancreatica. The main function of the hydrochloric acid is, however, with the aid of pepsin, another secretion from the stomach, to convert protein to peptone, and gelatin and elastin, connective tissue, to their corresponding peptones. Erepsin, which still further carries on the digestion to amino-acids, is said to be found in the pyloric secretion. The pepsin is found both in the fundus and in the pyloric secretion, and is much more persistent than the acid. In fact, whenever hydrochloric acid is found in gastric contents, this always assures us that pepsin is present in sufficient quantities to carry on the digestion perfectly, and only in those cases where the acid is absent (achylia, gastric cancer, and atrophic gastritis) is it necessary to test for pepsin. The rennin is always secreted as an inactive substance, which becomes active through the agency of the hydrochloric acid; its action is to coagulate milk, and its production always suffers when the secretion

of the acid suffers diminution. Still, its detection has never been of very great diagnostic value, and there are many who contend that pepsin and rennin are identical substances. The stomach steapsin must also be mentioned, which has the power to split fat into glycerin and fatty acid in an acid medium, particularly if the fat be emulsified; but, since we have learned how readily the duodenal content, with its pancreatic steapsin, can come through the pylorus if the stomach contains an excessive amount of fat, the origin of this ferment in the stomach becomes more doubtful. Taken altogether, we see that half the burden of the digestion of protein is borne by the stomach, and, while the pancreas can vicariously undertake the entire process, the frequency with which diarrheas occur when the gastric digestion is impaired—as in achylia gastrica, for instance—indicates what a burden is thrown on this secondary means of the digestion of protein and how often it fails to sustain it.

INTESTINAL DIGESTION.

As the motor functions play, perhaps, even a more important part than the purely chemical change in the food, we will consider them first. To do this intelligently, we must divide the intestinal tract into two portions—the small and the large intestine. The motions of the former are of a double nature. First, the rhythmic segmentations which Cannon has so well shown in his zooscope, consisting of contractions at short intervals from each other, whose sole object seems to be to mix the food thoroughly in the intestine and not in any way to advance it along the canal; these continue while there is food which incites them in the gut, occurring ten to twelve times per minute, and each one lasting five to six seconds. Second, there is the true peristalsis, which moves the food forward toward the anus, and consists of a contraction at some point where the stimulus is applied, beginning at that part nearest the stomach, and the relaxation of the succeeding portion of the intestine, by which the content of that section is forced forward. These peristaltic movements arise from special stimuli, and can be regarded as reflex in their character. Under normal conditions these stimuli proceed from the intestinal contents, and are of mechanical character, as rubbing or distention of the walls, but chemical influences also play a part, as the presence of organic acids, fatty acids, and gases. From this latter fact arises, no doubt, the empirical use of citric acid in lemons, malic acid in apples, and lactic acid in sour milk as means of stimulating the

peristalsis. These movements are always toward the anus, and anti-peristalsis does not take place here. As a great curiosity, there exists the so-called Exner needle reflex, by which, when a needle or other sharp object enters the intestine and its point pricks the mucous membrane, it causes a relaxation of the adjacent portion, so that the needle falls in a hollow and the peristaltic action carries the blunt end forward; this is accomplished by the layer of muscle known as the muscularis mucosæ. The passage of food through the entire small intestine requires from three and a half to six hours; vegetable food, and especially that rich in cellulose, passes much more quickly than meats, and the greater use of meat as an article of food at the present day may account for the increase of constipation. When the small intestine is empty, it lies still, except that every one and a half to two and a half hours a series of active movements take place, a fact known to the laity without its true explanation, who describe it humorously as the intestines chasing each other in search of food. All these movements are automatic, yet under the control of certain influences, among which we may mention the increase of peristalsis due to lack of oxygen or increase of carbon dioxide in the blood and mental influence from the brain, such as anxiety or fear, as the diarrhea which occurs in some patients only when they are far from a water closet.

In the colon we have a change in the movements in that the rhythmic segmentations and the peristalsis occur only in those parts where the content is still fluid or semisolid—that is in the cecum and ascending colon. Here for the first time we come on the reversed peristalsis, whose object apparently is to keep the contents longer for more thorough manipulation, where they remain, by the way, the longest time —viz., ten to fourteen hours. Whether this is a true antiperistalsis, or due to periodic contraction rings in the transverse colon or splenic flexure, has not yet been determined. As soon as the contents reach the transverse colon they begin to thicken and then the fecal cylinder is forced forward by tonic contractions, lasting three seconds and occurring every eight hours, which are excited by the entrance of new food or by defecation. This is well illustrated by Fig. 8.

The feces collect in the sigmoid flexure, and, when the mass has reached a certain volume it is forced into the rectum by contractions of the colon. When the feces enter the rectum, whether by contact with its walls or by distention is not known, we become aware of its presence and the reflex for defecation is aroused. If this call is not obeyed, it seems that a return to the sigmoid may take place. When

obeyed, the rectum contracts, both sphincters relax, and defecation takes place. After defecation takes place, which usually empties the contents of the sigmoid and the descending colon, the floor of the lesser pelvis is raised by the levator ani and the sphincters assume their normal state of contraction. This reflex center, which controls the whole process, is situated in the sacral portion of the spinal cord,

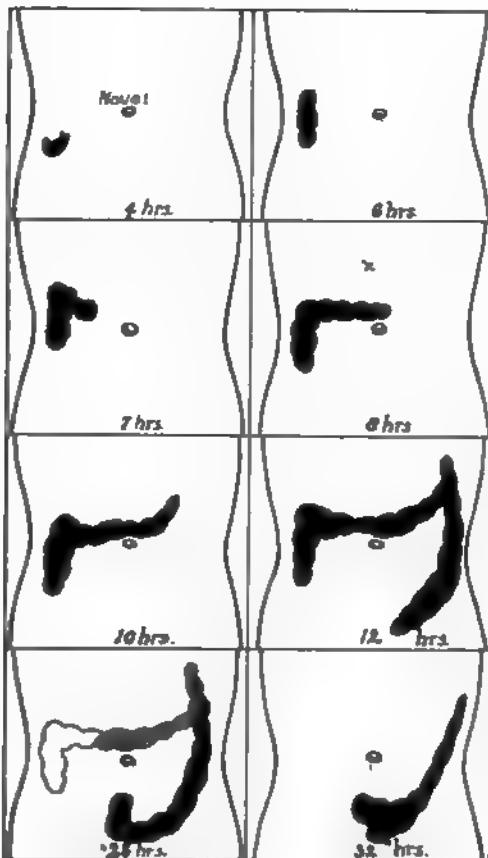


Fig. 8.—Normal movements of the contents of the colon, according to Hertz.

with perhaps a secondary one in the lumbar portion. What interests us more is the fact that, when the center in the sacral portion is destroyed by disease, the external sphincter remains permanently relaxed, while, when the destruction is above the lumbar part, it remains in a state of tonic contraction and can not be influenced by voluntary effort. In both cases the rectum is without sensation, and

stool occurs wholly by reflex action. The patients have desire for a movement, but from time to time, when the rectum is sufficiently filled, there follows a spontaneous emptying without the knowledge of the individual.

Sensation of the intestinal canal above the sphincters, as is found in the skin, is wanting, and it is interesting to note in operations on this canal what a slight degree of anesthetization is demanded, and how quickly more ether must be given as soon as the closure of the abdominal wall is attempted. Apparently the mucous membrane is sensitive only to distention—by gas, to pinching, and to pathological changes, such as anemia, cramp, and inflammation. The movements of the tract, both the segmentation and the peristalsis, can be controlled by drugs—as atropine, which diminishes the excitability of the mesenteric plexus and slows these movements; adrenalin, which excites the nerves which check such motions of the gut; nicotine and caffeine, which excite the motor apparatus even to cramps; and by laxatives which stimulate peristalsis by irritation of the mucous membrane or increase the speed of the contents through the canal by preventing the absorption of the water. The latter action is caused by salts. Inflammation of the peritoneum (peritonitis) also causes cessation of peristalsis.

By digestion in the stomach the food is prepared for further action of digestive agencies in the intestine, and the chief of these changes are the liquefaction of the connective tissue of meat, of the gluten of bread, and the middle layer of vegetable foods. The only substance which is really liquefied or in solution is the protein, and this to only fifty per cent. While the gastric juice in itself has no action on starch, it has been shown by myself and others that the diastatic changes, due to the saliva, continue for one to two hours after the food enters the stomach. The reason for this at that time was not known, but now we know that it is due to the arrangement of the food in the stomach in layers, so that the interior of the food mass does not come in contact with the hydrochloric acid, which in any considerable concentration inhibits starch digestion, for one or more hours after the food is taken. Besides converting the food to the consistency of gruel, the stomach corrects the temperature of too hot or too cold food, and dilutes and renders bland substances which are too concentrated or too irritating (pepper, mustard, etc.), before they enter the duodenum. Naturally the contents, entering, are strongly acid, but, due to the closure of the pylorus until this acidity can be overcome by the pancreatic juice, succus entericus, and other agencies, the

acidity in the intestine can never exceed a certain concentration, and it is supposed, where the acidity is much diminished in the stomach, that the food enters the intestine much more quickly and in a less liquefied form. Substances which produce an irritation of the intestinal mucous membrane and thus cause diarrhea, also induce a long closure of the pylorus. Furthermore, owing to the inhibitive action of the hydrochloric acid on bacterial growth, the food enters the duodenum practically sterile.

The secretion of the pancreatic juice, partially stimulated by the act of eating, is much more strongly aroused by the entrance of the acid gastric contents into the duodenum. In addition to the hydrochloric acid, fatty acids and soaps stimulate by their presence the secretion of this digestive juice, but neither alkalies nor neutral fats have the same effect. The character of the secretion differs according to the character of the food, but with the ordinary mixed diet the amount is about 500 c.c. per day. It is alkaline from the presence of 0.4-0.5 per cent of sodium carbonate, and contains enzymes for all three classes of food; the diastase, which digests both cooked and uncooked starch, like the ptyalin, but more energetically; the trypsin, not secreted in active form, but as a proferment, which requires enterokinase, which is also produced by the cells of the duodenum, only when pancreatic juice is contained in it, that dissolves and hydrolyzes all albuminous substances, except connective tissue, which, if not digested by the gastric juice, passes the whole length of the canal and is found in the feces; and some other less important protein bodies. This digestion of protein is carried much farther than in the stomach—that is, to the formation of amino-acids, from which the albumins of the blood are elaborated; and last, the lipase, which converts fats into fatty acids and glycerin, or directly to soaps when abundant alkali is present. The action of the last-mentioned ferment is vastly increased by the presence of bile, especially of its bile salts. Lecithin, which has now become a much used remedial agent, is also split by the steapsin. The bile acts not only as an aid to fat digestion, but also contains many inert substances, like cholesterin, biliary coloring matter, and a nucleoalbumin, all of which have no function in digestion; this secretion is produced continuously, but flows from its reservoir, the gall bladder, only in answer to certain stimuli, fats or albumoses, into the duodenum. We may see some physiological reason in this for the empirical use of olive oil to increase the flow of bile through the common duct, and thereby prevent stagnation, as well as to sweep back the bacteria which are supposed to

invade the gall bladder from the intestine. The amount of bile secreted daily amounts to 700-800 c.c., and, outside of its sodium taurocholate and glycocholate, which activate the lipase, has no digestive action, but holds the fatty acids and soaps in solution, which is of immense advantage to absorption of fats, a fact easily proven by the fatty stool when the bile fails wholly or in part of entrance into the alimentary canal.

The succus entericus interests us chiefly on account of several enzymes which it contains, not found elsewhere, but having a marked influence on the general digestion. For instance, we find here invertin, which splits cane sugar into grape sugar and fruit sugar; maltase, which breaks up malt sugar, the result of the diastatic digestion of ptyalin and the diastase of the pancreas, into grape sugar; and lactase, which splits the milk sugar into grape sugar and galactose. It is of practical importance that the last named occurs regularly only in the nursing child and disappears when the child takes up a mixed diet, but will return in the adult when, for any reason, he is kept on a milk diet. Still, we may account for the fact that the adult cannot utilize milk as well as the infant, and that adults often respond to an exclusive milk diet with diarrhea, by the supposition that temporarily no lactase is present in the intestine of the adult. Much less important, and as yet only physiological curiosities, are erepsin, which splits the albumoses and peptones into the amino-acids and nuclease, which thoroughly disintegrates nucleoprotein and nucleic acid, and possibly has some influence on uric acid metabolism. We are sometimes surprised when the small intestine is opened, as is common in the operation of gastrojejunostomy, to find so little material in the intestine, considering the enormous amount of the digestive fluids which are poured into it. Apart from the short period of fasting which precedes this operation, we also have to take into account the small portions of food which are passed into the intestine at a time by the regulatory action of the pylorus, the rapid progress through the small intestine, and the absorption which begins in the upper portions of the canal by which a large portion of the properly digested content is rapidly removed.

As soon as progress from the large to the small intestine takes place through the ileocecal valve, we find the contents begin to thicken, and that but few food fragments, recognizable to the naked eye, are found in them; the microscope shows a few meat fibers, some starch granules inclosed in their cellulose coverings, as well as some free granules and some fat, but no amino-acids. The colon secretes no di-

gestive ferments, but the remnants of the duodenal secretion are sufficient to continue the process of digestion, at least in the cecum and the ascending colon; until the rapid thickening of the content brings even this to a halt. Beginning with the cecum, we find an active bacterial action taking place which can split fat, digest a portion of the cellulose still remaining, check the process of fermentation hitherto predominant, and even destroy its products. This has a double significance in that, though pancreatic juice may fail to enter the intestine on account of obstruction, fat will be well digested and cellulose be so well disintegrated that the natural stimulus of the colon is wanting and constipation results. Our experience with nutritive enemata shows us, however, that all the products of digestive action in the colon are not destroyed by bacteria, else no nutriment would be absorbed from such a method of sustaining life. Absorption, a function of the intestine equally important with digestion, shows a predilection for certain substances; for instance, water is eagerly taken up, and even by excessive drinking of water we cannot make the stools liquid. Sodium chloride is readily absorbed, but sodium and magnesium sulphate are not at all, or to the slightest degree, absorbed, but rather withdraw water from the fluids of the body, on which is based their laxative action. Calcium also is another substance which seems to undergo no absorption, except such as may undergo conversion in the stomach to the chloride, and, in fact, is freely eliminated by the colon.

Probably maltose is the only double sugar which can be absorbed without being split, and there is ample evidence that it is split, before it reaches the liver, to grape sugar. Of protein we can say that only the minutest portions are absorbed in any other form than as amino-acids. The body can build up its own structure only with like albumin, and to do this all foreign albumins must lose utterly their own identity before they can be utilized, and this is accomplished by converting them to the simplest ingredients with which we are familiar. There is ample evidence of this in the rapid elimination by the kidney of a foreign albumin like that of egg when injected, or, as in some diseased conditions of the intestines, when absorbed before completely broken up. It goes without saying that, from recent investigations, it is fully established that all fats must be split before absorption, but all need not be converted into soaps, since, if some are, their solution in water will carry the fatty acids contained in the emulsion through the villi to the circulation, while, in this journey, all the acids find glycerin enough to pair with them and appear once

more as globules of neutral fat. Paraffin and vaseline pass through the canal without saponification, and from this is derived their value in constipation, since they are not absorbed. Hematin is very poorly absorbed, and hence the care to be employed in preventing the patient from taking meat or any of its products when a chemical test for blood is to be made in the stool. Of the gases, carbon dioxide is readily absorbed, marsh gas much less so, and hydrogen the least of all; what influence this may have on flatulence, since all these gases are produced from the food by bacteria or fermentative action, is not definitely known.

On account of the very important part which the bacteria play in the intestine, particularly the lower section, a little more attention must be paid them. It has been demonstrated that one-third of the total dried feces consists of bacteria, of which 99 per cent are found dead in the stool. These, however, at some period during their passage through the canal must have lived, so that the colon contents are subjected to the action of at least 128,000,000,000 of bacteria; their action is chiefly exerted in the cecum and ascending colon, and it is probable that the beginning thickening of the contents in the transverse colon is responsible for the death of the majority of them. It is peculiar that in the small intestine, apart from the lowest section of the ileum, the bacteria do not flourish, partly due, no doubt, to the inhibitive action of the hydrochloric acid of the stomach, which has already been mentioned, to the rapid absorption of the food elements by which food for their growth is removed, and the well-known fact that a normal mucous membrane can destroy the microorganisms which come in contact with it. This power, however, is limited to the normal intestine, and, when there is the slightest hindrance to the passage of food through the duodenum, or its mucous membrane becomes diseased in the slightest degree, then there is abundant growth of these minute organisms, and it is probable that many instances of cholecystitis are due to their invasion of the common duct and journey hence to the gall bladder. There is a vast number of varieties of these growths, which vary in preponderance according to the food taken, but we are chiefly interested in the *bacillus coli communis*, which is usually in excess on a mixed diet, and the *bacterium lactis aerogenes* on a milk diet, as well as less numerous yeast spores, butyric acid bacilli, and *sarcinæ*. The chief source of putrefaction is the *bacillus putrificus* and *bacillus sporogenes*. While in the small intestine (lower portion) the chief activity of the microbes is upon the carbohydrates, producing carbon dioxide, lactic, butyric, and acetic

acids, hydrogen, and marsh gas, below the ileocecal valve the action is upon the proteins, evolving ammonia, sulphuretted hydrogen, indol, skatol, phenol, and kresol; furthermore, by their activities bilirubin is reduced to stercobilin, which gives the color to feces, and cholesterin to coprosterin. The former substances are absorbed and rendered innocuous by union with sulphuric acid, and on them is based the whole theory of autointoxication of intestinal origin. The amount of these noxious substances produced is so slight, however, that it is incredible that they can produce a deleterious action on the body. Much more are we led to believe that this activity of the organisms is of value, since it converts a portion of the cellulose into substances available to the body and for which no digestive ferment exists, and also produces elements which stimulate peristalsis and aid defecation. At least, we can not quite hold with Metschnikoff, that the putrefactive products are responsible for arteriosclerosis and early old age. The intestinal tract is looked on as possessing the functions of digestion and absorption, but we must not lose sight of the fact that it also has the power of elimination, as is proven by the presence of no inconsiderable amount of feces in the fasting individual; furthermore, we have the instances of elimination of mercury by the colon and of urea in case of damaged kidneys. The stool of the fasting is made up of the residue of the bile, the biliary acids having only digestive power, and, being reabsorbed, of the eliminative products of the intestinal walls, consisting chiefly of salts, fats, desquamated epithelial cells, mucus, and the characteristic nucleoprotein of the inner intestinal coat found in every stool. Hence it would appear that two-thirds of the fecal nitrogen arises from intestinal eliminative products and not from food remnants. It is true that the food remnants practically never fail in the stool, but the amount varies very much with the character and preparation of the food; for instance, and this is of practical importance in the treatment of constipation, the food element in the stool largely increases when uncooked or underdone connective tissue (scraped beef, rare beef), mutton or beef tallow and raw vegetables (celery, radishes, lettuce, etc.), are taken as food, on account of the large cellulose content, and, on account of their lack of digestion, a larger portion of the otherwise digestible and absorbable food goes with them.

CHAPTER III

EXAMINATION OF THE PATIENT

This term is advisedly used rather than examination of the stomach or gastrointestinal tract, for we must at first examine all the organs of the body rather than the organs alone in which we are interested, since nothing could be more unsatisfactory for the physician nor more disastrous for the patient than, when we find an abnormality in the functions of any part of the alimentary tract, to be satisfied with this discovery. For instance, we may find that a so-called gastric catarrh owes its existence to an incompetent cardiac valve, and all efforts to overcome the secondary effect of this will be unavailing unless we direct our attention to the original lesion; hence a careful examination of the heart is always to be made. Again, we find a deficiency of gastric juice, or even a complete achylia, in an individual who has been losing flesh and perceptibly growing weaker without any definite cause; here a careful examination of the lungs will often demonstrate a so-called pretubercular stage of pulmonary consolidation without the classical symptoms of the fully established disease. Or, again, we find fullness after eating, eructations, and sometimes slight attacks of pain of short duration, with absolutely no abnormality of the stomach that can be discovered, but a careful palpation of the gall bladder region will elicit tenderness, and often an examination of the urine will show a slight trace of bile, a feature much more important, in my mind, than yellowing of the sclera, and we have demonstrated a cholecystitis as the cause of the reflex stomach symptoms. In fact, following the old French axiom, "cherchez la femme," whenever gastric symptoms are present without demonstrable abnormalities in the stomach itself, look for the reflex. Always bearing in mind the normal conditions, we may examine the stomach, either directly by determining its position and size as well as the character of its contents, or we may examine it indirectly in determining the presence of extensive connective tissue fragments or chemical blood in the stool, the former of which indicates a deficient gastric juice, and the latter, if symptoms pertain to the epigastrium, gastric hemorrhage.

The direct method of examination includes inspection, palpation, percussion, auscultation, diaphanoscopy, and gastroscopy, the latter two now little used, and the more recent and much more valuable röntgen ray examination. In addition to these, we have, of course, the examination of the gastric contents at stated intervals after the ingestion of certain foods, but the last has been often disappointing to those who expected to make diagnoses on the finding of these chemical examinations alone. Where the intelligence of the patient is evident, the history of the present and previous illnesses on which the former may be based is undoubtedly valuable, and should, of course, always be investigated, but it is astounding how often cultivated people can tell you little or nothing of the length, frequency, and severity of an attack of pain, but have clear and well-defined opinions with reference to what foods agree and what do not, and among the latter you find those which science tells you are the most easily digested. In a clinic practice, which usually deals with the most ignorant, a history is much less valuable; former illness and suffering are usually lost sight of in the present discomfort, in the detailing of which by the patient the important features are ignored and the unimportant dwelt upon, and only by leading questions can what is sought by the physician be obtained, a method always subject to great error in an oversusceptible grade of society. Thus the physician is driven to the knowledge acquired by his eyes, ears, finger tips, and such aids as chemical tests afford him. As to the order in which such an examination should be conducted, every medical man is a law unto himself, provided that nothing escape his attention. The history may be learned in a short biography of the patient from the cradle to the present illness, with its symptoms, which will often include a lot of irrelevant matter, or the method of Cabot may be followed, which lends itself admirably to clinic examinations, and consists of learning the leading symptoms; from that we branch out to learn its relation to conjoint symptom, its probable cause, its connection with previous attacks of illness, and its possible dependence on a family trait or disease.

Then the physical examination should follow, in which every organ of the body should be interrogated, and the gastric contents withdrawn, if the patient can tell you what he ate, when, and the approximate amount. The results of the chemical examination will often give one a better knowledge of the state of the digestion than bread and water fare, for reasons stated before, and the removal is rarely difficult, except within an hour after meat is eaten, when the fragments may

stop the eye of the tube. The urine is to be examined briefly for bile pigment (cholecystitis), indican (intestinal stasis), diazo reaction (malignant disease), and Ehrlich reaction (hepatic disease). If anything out of the ordinary be found, a portion of the twenty-four hours' urine may be examined at the next visit, at which time the meat-free stool may be examined for chemical blood, or the Schmidt or other simple diet stool examined for deranged gastric or intestinal digestion. At the second consultation, too, it is often found convenient to have the patient come without breakfast, but having eaten what is termed a hearty meal the evening before, to which has been added some boiled rice and raisins, when the stomach is washed out for the stasis test, and then the Boas-Ewald test breakfast may be given if certain points, like absence of hydrochloric acid (free) in the contents at the first examination, demand it. The x-ray picture or pictures, if thought necessary, are usually made by special appointment with the röntgenologist at still another period. This is the usual experience both in clinics and in private practice, but, where time presses and the patient can be communicated with beforehand, he can come with no breakfast after the Riegel meal of the night before, with his stool in a Mason jar, and all can be accomplished at one sitting.

THE HISTORY.

While acknowledging the frailties of this method of examination, still it must be conceded that much valuable information can be obtained, and, whenever a patient comes to us complaining of symptoms directed toward the digestive organs, we must make a careful inquiry into each feature of his discomfort, and try to make him particularize and not be content that he describe his difficulty as "stomach trouble," a term generally used by the laity to designate anything occurring in the abdomen. Many times the patient's description of his departure from health has a particular significance when absolutely nothing objective can be discovered, and the more bizarre his tale and the more inconsistent with all laws of digestion, as determined by experiment, the more valuable it is, because it indicates so strongly a functional affection. The history concerns itself, first, with general conditions and previous diseases which may have some causative connection, and, second, with the analysis of the present difficulty.

General Conditions.—*Age and sex* play their part. In puberty, as well as at the climacteric, functional gastric disorders are very common; gastric cancer, however, though it may rarely occur in youth,

generally occurs after fifty. The idea that gastroduodenal ulcer, a safe term on account of the hairline anatomical difference in the site and similarity of symptoms, is confined to youth has never been substantiated and, if one may judge from clinical experience, confirmed by operation, men and women suffer in equal measure from this disease. Women, however, are unquestionably more prone to gastric neuroses, enteroptosis and cholecystitis, while stomach symptoms are complained of whenever the generative organs are diseased, and functional gastric difficulty is always exaggerated during the menstruation. It is also known that when a splanchnoptosis is present, though it is congenital and has existed from birth, the first symptoms with reference to the entire tract (eructations, constipation, etc.) come on at the time of puberty. Intestinal catarrhs usually appear in both men and women at the period of greatest exertion, the one to succeed in business and the other to attain a place in society, which means, usually, irregular and rapid eating. The constipation of young girls may come on in connection with chlorosis, while the colon catarrh of women usually dates from some confinement (tears and displacement of the uterus). Inattention to the act of defecation on the part of young girls on account of modesty, false though it may be, often starts a train of intestinal symptoms which last long after common sense has replaced this false modesty.

Heredity.—There is very little evidence that diseases of the digestive tract are in any way transmitted from parent to child. It is sometimes observed that the condition known as status enteropticus, where there is a general ptosis of the abdominal organs, may be found in two generations, but, as Stiller has remarked, it should rather be considered as an asthenia universalis congenita, and hence the inheritance of general lack of physique, rather than an inherent weakness of the digestive organs. Then, too, we have instances where so-called nervous dyspepsia may be found in two or three generations, but it is as likely to manifest itself in some other form of nervous weakness in the next generation as in a weakness of the digestive organs, and hence is not peculiar to those. There has also been some question of the heredity of cancer of the tract, but about all the evidence collected, apart from the well-known frequency of this disease in the different generations of the Napoleon family, which indicated a transference from parent to child, is contained in the statistics of the Zurich clinic, where, of 138 cases of cancer of the digestive organs, 8 per cent of the victims had had ancestors who were also afflicted with cancer of similar organs. It is much more probable that,

if we take into account cancer of all organs, we may find this heredity much more pronounced than when we confine it to the digestive tract.

Occupations of certain kinds are especially prone to digestive diseases, such as the bartender, who, from the temptation to indulgence in alcoholics, is frequently subject to chronic gastritis, either from direct irritation of the stomach or from the cirrhosis of the liver, which so often accompanies it; cooks, too, are said to be much more liable to gastric ulcer, whether from the frequent tasting of food, as is supposed, or from the heat in which they usually work, cannot be told. Workers in lead, such as painters and typesetters, are always constipated, and directly or indirectly are sufferers from various gastric difficulties.

Then, too, we have the workers in soft phosphorus, the match-makers, who, apart from the so-called "phossy jaw," are very apt, on account of the almost universal inflammation of the digestive tract, to suffer from vomiting and more or less bloody discharges. Thanks to the efforts of our legislators, both in this country and abroad, the use of soft phosphorus for this purpose either has been or soon will be forbidden. Laborers engaged in the reduction of ores, milliners handling artificial flowers, and others often suffer from diarrheas from the absorption of arsenic, which, through its elimination by the intestinal mucous membrane, produces marked hyperemia, hemorrhage, and sometimes ulcerations. The same thing is also true of those who work with mercury, and it has not been unknown among those who take calomel internally or use corrosive sublimate externally, though the use of these drugs is much less common by the medical profession.

Duration of Illness.—Here must be taken into consideration whether the illness is acute or chronic, whether it is persistent or recurring, or periodical. Gastric ulcer is noted for its apparent cures, which may occur several times under the "ulcer treatment" and still return; whether the patient is free from difficulty during the interval, a peculiarity of cholelithiasis, which notoriously produces stomach symptoms like pressure in the epigastrium, sometimes pain extending through to the back, which is not severe and is often relieved by free eructations of gas, must be ascertained. Appendicitis, too, is distinguished by its intervals of comparative freedom from discomfort. Gastric crises, intermittent gastric hypersecretion, often associated with migraine and the temporary digestive disturbances, associated with the menstruation in women, are all noted for the regularity with

which they appear at definite intervals. More recently a periodicity has been noticed in the attacks of pain in duodenal ulcer.

Former Sicknesses.—The medical profession is all too ready to associate earlier diseases in a causal relation with later ones, and perhaps often without sufficient ground; but, when patients with gastric symptoms describe an earlier threatened pulmonary tuberculosis or recovery from the same, we may regard an achylia as the direct outcome of it, or, when patients of well advanced years describe an early gastric ulcer, we may well look very carefully for malignant disease. The association between malignant disease and injury is not so clearly proven, yet many instances have come to me where there was a close connection, the most recent an annular carcinoma of the descending portion of the colon, six years after a carriage accident in which three ribs were broken on the left side, but with intestinal symptoms dating back four years or more from discovery of the lesion. A history of an acute heart attack, with many years of comfort, may well make us look sharply for so-called "gastric catarrh" and cardiac decompensation. A history or suspicion of previous syphilis may cause attacks of epigastric pain to be assigned to their proper category—manifestations of spinal sclerosis—which will usually be verified by loss of reflexes and lack of coordination. A history of previous "nervous prostration," treated at home or in a sanatorium, will often minimize your patient's tale of great gastric suffering, and you will easily verify a nervous dyspepsia, though the former can hardly be said to be a cause of the latter, but another manifestation of the same general weakness.

Causation.—Patients often have a ready explanation for their attack of "stomach trouble," as they call it, and most often it is some inoffending article of food that is held guilty. It will often be found, however, that the meal of which this food formed a part was eaten hastily or in a state of mental agitation, or, more often, that slight disturbance had existed for a long time previous to which no attention had been paid, but everything dated from the period when the attack had been most severe. It is curious to note how in the patients' minds gastric cancer, which is of very slow growth, dates from a definite period when they had a particularly sharp attack of indigestion; hence it is not wise to put too much dependence on the patient's explanation of the cause of his illness, or we may be led into error. That an accident may cause gastric ulcer seems well established, and has twice come under my own observation in so close a connection that there could be no doubt in my own mind. There is

no question, too, that spoiled food may excite an intestinal catarrh, which often gains the more dignified term of "ptomaine poisoning," something entirely different by the way, which catarrh, neglected, may easily become chronic.

Dependence of Digestive Symptoms on Coexisting Diseases.—Dysphagia and regurgitation are sometimes produced by the pressure of an aneurism on the esophagus, and Professor Oser, of the Vienna polyclinic, used to show a pathological specimen in which death had occurred from the rupture of an aneurism into the esophagus of a patient into whose stomach only lack of time had deterred Oser, the day before, from introducing the tube to explain the patient's obscure gastric symptoms. Gastric symptoms, like heartburn and vomiting, may arise from cancer of the ascending colon or from that of the splenic flexure. Chronic appendicitis may affect not only the motility of the stomach, but also its secretion, usually by lessening the one and increasing the other. For a long time cirrhosis of the liver manifests itself by gastric symptoms, which, as stated, are also caused by cholelithiasis. When menstruation alone may change, under physiological conditions, the secretory functions of the stomach, we may expect many functional disorders of digestion at the periods of pregnancy and the climacteric. These, too, we actually find, and treatment directed toward the stomach itself at these periods is much less effective than that directed toward uterus and adnexa. Raising a flexed uterus has often checked vomiting, and removal of a small ovarian cyst has relieved gastric discomfort. As all physicians know, nausea, eructations, vomiting, and diarrhea may be the first symptoms of a nephritis when uremia is present, as well as very common symptoms of an acute indigestion. In a much less violent form these symptoms may be present for a long period in chronic nephritis, and naturally are the symptoms to which the patient's attention is directed, rather than to a slight edema or an increase of urine. While the examination of the urine quickly clears up this confusion, we must not lose sight of the fact that, where there is gastric stasis or, as some say, intestinal autointoxication, a trace of albumin, which is often of the nucleo variety, must not be misinterpreted. Reflex digestive disturbances are often associated with cystitis and, particularly, with retention of urine, due to enlarged prostate in men and ureteral stone or kink causing pyelitis or pyelonephritis in women. In a recent case, whenever the pelvis would fill with urine (hydronephrosis), there occurred a persistent diarrhea. It is astonishing sometimes how quickly the relief from these urinary disorders clears up the gastric

symptoms. We have also heard very much concerning the gastric symptoms associated with prolapsed or movable kidney, and many a suspension of the wandering kidney has been done without relief of the stomach difficulties. In all probability Stiller solved the problem when he found that prolapse of the stomach was associated with the dislocated kidney and caused the digestive symptoms. Pharyngitis, particularly the chronic form, often produces a feeling of nausea, which is attributed to the stomach, and efforts to clear the throat, associated with gagging, may bring on vomiting. Furthermore, those who suffer from emphysema, either from the persistent cough, which through the diaphragm must keep the stomach in a state of unrest, or from engorgement of the stomach walls with blood on account of the impaired circulation through the lungs, often have associated stomach symptoms. It is frequently difficult, too, to distinguish the pseudoangina pectoris, due to distention of the stomach with gas and pressure on the diaphragm, from real angina; usually an attack of the former comes on after eating, and of the latter after exercise.

Neuroses may cause all sorts of gastric symptoms from pain—gastralgia, as it is sometimes called—to prolonged vomiting, while the same functional nervous disease produces all forms of irregularities in the gastric secretion from hyperchlohydria to a complete achylia; associated with them in etiology may be found also hypersecretion, both alimentary and continuous. A whole chapter might be written on nervous dyspepsia and its relation to certain psychoses. Many patients date their whole train of symptoms from grief or fright, and one of the early humorists describes the manifestations of overstudy in words which are as true today as when written, and, as today, the greater stress is laid on those pertaining to the stomach. Still, we should not be content to lightly make the diagnosis of gastric neurosis without a most careful and searching examination for some physical cause for the "neurosis." Sometimes it is a blood disturbance like chlorosis, sometimes a chronic ulcer without acute symptoms, rarely a genital difficulty like inflammation of the deep urethra or the seminal vesicles and, last but not least, intestinal parasites, especially teniae. It is also noted that patients suffering from long gastric distress become neurotic, weep readily, suffer from insomnia, and find it very difficult to give the examining physician a clear idea of the origin of their illness, which, when elicited, points clearly to symptoms pertaining to the digestive organs, but which has been overshadowed by their other sufferings. Many digestive disorders are dependent

on blood diseases, such as pernicious anemia, which almost invariably produces an achylia so complete that, in conjunction with the evident appearance of cachexia, I have known distinguished surgeons to operate for malignant disease of the stomach.

Many metabolic diseases, like diabetes, produce gastric symptoms like bulimia or "ox hunger," gastric crises, and gastralgias, while gouty diathesis causes the "gouty" stomach of the English, and Basedow's disease may produce a persistent diarrhea.

Infectious diseases also induce digestive disorders. The effect of pulmonary tuberculosis has already been mentioned and the prodromal stage of typhoid may be characterized only by malaise and gastric symptoms.

Emaciation.—It may be readily seen that loss of weight may accompany gastric disorders from physiological causes, such as loss of appetite, restricted diet, and fear of eating—in fact, in the eyes of the laity, dieting usually means semistarvation—so that emaciation of itself does not necessarily mean organic disease, but in organic disease of the gastrointestinal tract, especially when associated with pain, one notices a disproportionate loss of flesh. With malignant disease of the esophagus and stomach, the loss is sometimes startling and rapid; in the latter case not only when there is produced narrowing of the pylorus, associated with great pain and vomiting, but also when the growth is found in the body of the organ, producing neither of these symptoms. Such emaciation may be found where the food is ample to meet the demands of the economy, and, under these conditions, great and rapid loss of weight are very suggestive of cancer of the stomach, or in some instances of other parts of the tract. That a part of this loss of weight is due to the vomiting and lessened food consumption is shown by the very slow loss when gastrojejunostomy has been performed for relief of symptoms of stenosis in cancer of the pylorus. Curiously enough, cancer of the lower intestinal tract does not produce, in any marked degree, such loss of flesh. We may often see patients with cancer of the rectum or sigmoid in a very good state of nutrition, and be first apprised of the dangerous character of their malady by a sudden obstruction or a persistent diarrhea.

Character of Food and Manner of Life.—Many digestive disorders are brought about by improper cooking and unsuitable articles of food. Few of us have escaped at times the frying-pan and hot soda biscuit; heavy gravies and greasy hashes have proved many a patient's Waterloo. Nor is the damage always to be attributed to the character of

the food or its preparation; rapid eating and insufficient mastication have made the American race a nation of dyspeptics, while the introductory glass of ice water is tolerated by no other nation. Then, too, the after-the-theater supper, eaten after a hard day's work and three hours in a stuffy theater, often puts an end to the tolerance of a much-abused digestion and a surgeon removes the rebellious appendix. Excessive use of tobacco, tea, coffee, and condiments often play their part, and should always be inquired into.

Mutual Reaction of Different Diseased Parts of the Digestive Tract on Each Other.—The presence of cholelithiasis is generally recognized as producing a hypersecretion of the stomach, which manifests itself as "heartburn," and is one reason why so many affections of the gall bladder impress themselves on the laity and often on physicians as gastric disorders. Then, again, a gastric achylia is often associated with a pancreatic achylia even if the latter is not the direct outcome of the former, and associated with both we have a diarrhoea, often termed lienteric. Chronic appendicitis, furthermore, may produce a hypersecretion of the stomach, and recent observers think that it causes gastric hypotony as well.

SUBJECTIVE SYMPTOMS.

Appetite and Sense of Hunger.—While appetite and hunger are physiologically different, patients do not distinguish between these two, and clinically there is little gained by differentiation, since they go hand in hand. Sometimes one is told by patients that they have a feeling of faintness at regular intervals, which is a distorted sense of hunger, but that no food tastes good, and hence there is no incentive to more than superficially satisfy the hunger, a statement which is to be interpreted as a lack of appetite. These two conditions are associated with all kinds of disturbances of digestion, and, if by questions one can learn that sufficient intervals elapse between taking food, they are usually the earliest and most reliable of the symptoms which indicate a disease of the digestive tract, whether functional or organic. There are people, however, who are addicted to "nibbling," taking some food almost every hour during their waking moments, and with these lack of appetite is to be expected and has no significance. The appetite in those suffering from digestive disorders may be persistent, erratic, varying from time to time, or may be entirely absent. The loss of appetite, too, is not always to be ascribed to disease of the digestive tract alone, as witness its presence in many febrile dis-

turbances and in chlorosis. Not only may the appetite be absent, but there may also be utter disgust for certain forms of food, as for meat in the sufferer from gastric cancer. Again, hunger may be so intense that the patient is absolutely miserable when the stomach is empty, with trembling hands and an impending sense of fainting, to be allayed only by taking food. Such an "ox hunger," described in the *Anabasis* as the complaint of one of the generals in that campaign, may be associated with functional dyspepsia or may be a symptom of gastric hypersecretion. Then, too, there are certain persons who have a desire for food which is highly seasoned, or who can eat only such food as is covered with the various sauces like Worcestershire or catsups. Many people are satisfied with a few mouthfuls and after this point is reached have to be urged to continue, while others require large amounts of food before they acquire that sense of comfort and gratification which goes with a full stomach in health. This often carries them to a point where more than the necessary calories for the needs of the body are taken—a false sense of hunger, as it were—and obesity follows. All these peculiarities are of diagnostic importance, for each is often associated with a particular form of disease of the digestive tract and with no other. In gastric catarrh due to cardiac failure and hepatic cirrhosis the appetite is lacking or much impaired, as it is also in achylia. In gastric ulcer the appetite is maintained or increased, while most of the erratic changes in appetite, disgust for certain foods, desire for inedible articles like slate pencils, chalk, etc., arise from gastric neuroses. Functional constipation and chronic appendicitis may cause impaired appetite apart from the fear of the pain in the latter condition, which is often aroused by over-distention of the stomach with food.

Disturbances of the Sense of Thirst.—Great increase, apart from diabetes, usually comes from those digestive disorders which are associated with frequent vomiting or diarrhea. Pyloric stenosis, too, where large quantities of fluid are retained in the stomach, greatly increases the desire for fluid, and to the inability to get liquid to the tissues in this condition is often ascribed *gastric tetany*.

Disturbances of Taste.—These disturbances are usually found in acute indigestions, so-called bilious attacks, in chronic gastric catarrh, and fermentative and putrefactive processes in the stomach, as in an ulcerating cancer. Particularly in the last do the patients complain of the taste of overripe—i.e., high game or meat—while usually the complaint is of a bitter or sour taste. There is usually no complaint of unusual taste either in gastric ulcer or hypersecretion.

Feeling of Pressure and Fullness.—This sensation may occur in all grades of severity of gastric disorders from the merest functional dyspepsia to early gastric cancer. It may occur after eating and disappear one or two hours after meals, or may continue until the next meal, or be present only when the stomach is empty and disappear for a time after eating. Sometimes its severity depends on the nature or amount of food, and again it seems to follow no known law. In practice in the clinics among unintelligent people this sensation is always referred to as a pain, and careful questioning must be employed to differentiate them. Almost every one has at sometime had a toothache, and a query as to whether the pain is as severe as that ill brings out the fact of the feeling of fullness or pressure. Some complain of it after the very first mouthful, and are relieved by eructation of gas. Lately we have noted that this feeling may increase to almost unendurable intensity, extending through to the back, and under these conditions cholelithiasis is often the cause. Other than this, it has no diagnostic value, since it is found under so many conditions. At times this sensation is not due to a stomach condition at all, but to a distended colon, and is exaggerated when the stomach fills with food from pressure of a normally filled viscous on a distended colon, and relief comes not from eructations, but from free passage of gas from the anus.

Pain.—This symptom, of all others, requires the most careful interpretation, because one patient will regard any discomfort as pain, while another will deny the presence of pain unless it is severe enough to "double him up," as he expresses it. Many describe their pain as stabbing, burning, gnawing, or oftener as stomach "cramps."

At first we must satisfy ourselves that the pain complained of is actually associated with the stomach, for patients generally ascribe all abdominal pains, whether from gall bladder or intestinal (lead) colic, epigastric hernia or renal colic, appendicitis or salpingitis, to the stomach, and we have heard the pains of extrauterine pregnancy described by a patient as stomach cramps; nor if they are asked to localize the pain is one much better off, for the whole hand is used, and an area of the abdomen is usually covered which might include almost all the abdominal organs. Asking the patient to point with the index finger helps some, but Cabot uses a term which promises much—put the patient in bed and allow the pain or tenderness to "localize." If, however, the patient describes the onset of the pain with the taking of food, it may be generally regarded as arising from the stomach, except in the instances of which we have spoken, where

taking food, especially in fairly large amounts, may arouse the pain of cholecystitis. This close connection of pain with the ingestion of food is especially noticeable in gastric ulcer, and more emphatic still is the fact that coarse foods bring on the pain promptly, while liquid food may fail to arouse it. This is not only true of gastric ulcer, but of malignant disease of the intestine, and Stiller recommends the use of coarse foods with a large amount of cellulose—like black bread, beans, greens, sourkraut, etc.—where any doubt exists by producing an attack of pain, and perhaps occult bleeding, to verify, for instance, the diagnosis of malignant disease of the colon. In case of gastric ulcer the pain often streams toward the back and left shoulder blade, and some patients even complain that the pain in the back is more severe than that in front. The pain of gastric ulcer, too, is exaggerated by moving about and lessened by rest in bed. Duodenal ulcers also have much the same characteristics in regard to pain, but the latter comes on much later, three to six hours after food, and is usually relieved for a time after food is taken. It must be conceded, however, that duodenal ulcers may exist without any pain, and patients are brought into our relief hospital almost moribund from hemorrhage from duodenal ulcer who never had a symptom severe enough to attract their attention.

The pain in gastric ulcer is probably due to the mechanical irritation of the food, the corrosive or chemical action of the highly acid gastric juice, and hyperemia about the ulcer. That the acid causes an attack of pain is often easily demonstrated by the readiness with which the suffering ceases when white of egg or an alkali is given the patient, though this may also be true where the secretion of an active gastric juice persists after the food has left the stomach, the so-called continuous secretion. With this condition, too, on account of the similarity of the symptoms, is often confounded a duodenal ulcer. Where a chronic ulcer exists we may also have a cramplike attack of pain from the spasm of the pylorus. Sometimes the pain streams to the right under the costal border, instead of to the left and back, and may then be mistaken for cholelithiasis, but the pain of the latter is more liable to occur at night, and, if an ordinary meal that is not excessive in amount is taken, less likely to be associated with food. The pain of gastric neurosis is characterized by its erratic nature. The patient says "sometimes it occurs and sometimes not." It may occur after excitement or may be absent, may be experienced when food is taken or when the stomach is empty, so that it is always wise to ask the patient, "When do you feel better, after you have eaten or when

the stomach is empty?" This erratic character of the pain may be found with ulcer, and sometimes we meet a neurosis where the pain is noticed only after eating. Pain which at least the patient ascribes to the stomach may occur in anemic individuals of the female sex, especially at the menstruation, and gastric pain is common in tabes usually associated with vomiting. In diabetes, pain in the stomach, as well as neuralgias elsewhere, is common, and recently pain of a spasmodic nature has been described in both the epigastrium and abdomen in arteriosclerosis. The pain in the latter condition has no relation to food, but is more often brought on by muscular effort. Its more frequent onset at night, its association with the prone position, and its conjunction often with angina pectoris make it less liable to be confounded with that of gastric ulcer.

The cause usually given for these attacks of pain is spasm of the smaller arteries of the gastrointestinal tract and the consequent increase in blood pressure. Very often the pain of intercostal neuralgia and gallstone colic is confounded with gastralgia, and it is most difficult sometimes to differentiate the latter two conditions. Gastralgia may occur, too, with an acute appendicitis, and is not unknown in the chronic form of this difficulty. Intestinal colic and renal colic may simulate a gastralgia, but in the latter case the pain streams along the ureter to the bladder region, even to the vulva in woman and the testicle and penis in man. Hernia of the linea alba, of the femoral and inguinal canal, and even a myalgia of the recti, may produce pain in the epigastric region, but in the latter instance Schmidt has called attention to the fact that the pain is associated with tenderness on superficial pressure, which is not increased on deep pressure. We should never be content, however, with the mere statement of the patient as to the site, extent, or time of the pain, particularly, as has been stated, when it occurs after food and leads us to think of gastric ulcer.

Abnormal Sensations in the Epigastrium.—These sensations may be confined strictly to this region, or may extend to the esophageal region. The sensation of a lump in the throat or of food sticking there, of which patients complain, may be the globus hystericus of hysteria, or it may be due, as Boas points out, to tough mucus adhering to the pharynx or esophageal walls, giving the sensation in the oversusceptible of this lump or obstacle. It has been our personal observation that, when only such a sensation is complained of, the tube passes readily into the stomach, and, when real obstruction exists, regurgitation of food is the chief symptom. Often the complaint

of a foreign body in the stomach is made, and many weird tales of lizards and snakes in the stomach, acquired by drinking from springs, etc., reach the newspapers. Such a sensation may be associated with a tumor of the stomach, but is more often simply a modification of the feeling of pressure and distention after food. In many instances these sensations are purely psychical, for, when the stomach is washed out, nothing is found. Very often patients complain of a feeling of unusual movements in the stomach; these usually occur in neurotics, and may be due to increased gastric peristalsis. Then, again, we hear of throbbing of the stomach, which, being coincident with the heart beat, is probably due to the pulsations of the abdominal aorta, and is generally associated with a prolapsed or overdistended stomach, or sometimes due to the increased blood pressure (noticeable to the patient) during digestion. Occasionally we have instances where this feeling of increased gastric activity is actually due to pyloric stenosis, but in many others the peristaltic waves are easily seen, but not felt by the patient, nor do they manifest themselves as "cramps." Much the same is true of the lower abdomen. Increased intestinal peristalsis often produces uncomfortable sensations without actual pain, and the stabbing sensation, often complained of by patients with sluggish bowels and more or less distention under the right and left costal border, is often due to increased activity on the part of the colon and spasmodic contraction of the hepatic and splenic flexures, which is verified by the occasional noisy rush of gas and temporary relief; these are the so-called "gas pains," a term much abused, for the same condition may mean an organic stricture, which is overlooked by our easy explanation of gas pains. Not infrequently we have found a patient with this complaint who had a well-marked ascites, and the distention which was considered due to gas turned out to be fluid, or else the gas filled intestines were pushed up against the diaphragm. Nervous people especially, when they are excited, may have an exaggerated intestinal peristalsis, accompanied by loud borborygmi, without any distinguishable distention or undue movements of the bowels, a condition often without discomfort, but very annoying to the patient because of indisposition to associate with others on account of the noises. Special caution should be taken not to regard these symptoms as due to organic stricture, for they are often found in well-nourished individuals.

Heartburn (Pyrosis).—This is a sensation of heat and burning along the esophagus, or rather under the breast bone, and sometimes in the pharynx, though patients usually say, when asked, that

no fluid rises into the mouth that can be tasted. It is generally associated with hypersecretion, and that often of a high grade, and should be differentiated from burning in the stomach, which is more often a symptom of fermentation of food, though it may be due to the same cause—too great a concentration of hydrochloric acid. Rarely, in both cases, acrid fluid does ascend into the mouth, having an extremely sour taste and giving the sensation of corroding the teeth. It may be noticed, too, where there is no increase in the normal acid of the stomach; in fact, sometimes the acid is diminished or wanting. In the last instance it is probably due to organic acids. Some would have us understand that there is a sensory peculiarity in some stomachs of such a character that, when the acid tide reaches a certain level, the patient suffers discomfort of this character until the food leaves the stomach—in other words, a hypersensitiveness to the normal acidity. The cause of this heartburn is variously stated to be the regurgitation of the acid contents along the normal esophagus, which, on account of its alkaline secretion, is peculiarly sensitive to acid, and by others to be due to relaxation of the cardia, by which the gastric contents easily reach the esophagus. At least we have noted in many cases of heartburn that the gastric contents, when removed, readily gush up around the tube instead of coming wholly through it. The esophagus, too, possesses a much greater degree of sensibility than the stomach, so that a degree of acidity which would cause no discomfort in the latter might produce considerable suffering in the former. Then, again, we have patients, otherwise perfectly well, who have this symptom only after certain foods like eggs (yolk), coffee (with cream and sugar), and fats.

Nausea.—This symptom usually precedes vomiting, and may be dependent on brain lesions (cerebral anemia, gummata, and tuberculosis) as well as gastric lesions. It is found in all forms of gastric neuroses, and the most obstinate cases with which we have ever had to deal were those where it arose in one instance from eyestrain and in the other from a purely nervous achylia gastrica; hence, from its varied etiology, it has but little diagnostic value. It usually comes on, when of gastric origin, directly after eating; in neuroses and hypersecretion it occurs when the stomach is empty, and can often be promptly relieved by eating. We find it naturally in the early pregnant woman and in the young girl at puberty, particularly when associated with chlorosis. It also is present with tape worm. Functional constipation also may be a cause of nausea, which can be removed by free catharsis.

Difficulty in Swallowing.—This condition, while not really one of the gastric symptoms, is so closely associated with them that it should be considered here. Specially low-lying strictures of the esophagus are mistaken by the patient, and also very often we are sorry to say, by the profession, for gastric affections. Often only from the patient can it be learned that the food feels as if it stuck under the breast bone, and demands a glass or two of water to dislodge it, and that fluids are borne much better than solid food, a statement equally true of stomach affections, and the pain, strange to say, is always attributed to the epigastrium. We have seen an early malignant esophageal stricture, 34 cm. from the teeth treated three months in the out-patient clinic of one of our best hospitals as a gastric neurosis. Schuetz calls attention to a statement, often made by the patient, that he can digest fat meat much better than lean meat as suggestive of stricture, since the fat meat goes through much better, while ordinarily fat is less easily digested in pure gastric disorders. Deglutition hindrances may exist equally well from spasm of the pharynx or esophagus in nervous individuals or inflammatory disturbances in both regions. Both from paralysis of the deglutitory muscles and diverticula due to atony we may have difficulty in swallowing, while true stricture due to other causes than peptic ulcer and malignant disease is much less common in this country than in Germany, where the beer and lye are kept in similar bottles and often in the same cupboard.

The statement of the patient that fluids can be swallowed without difficulty, while solids give trouble, must always arouse the suspicion of organic stricture, whose nature can be determined only by thorough examination of the esophagus—first with soft tubes, and then, if these fail to go through the narrowing, with solid esophageal sounds.

Eruption (Belching).—This consists of voluntary or involuntary elimination of gas from the esophagus or stomach through the mouth, which may consist of swallowed air, of gases contained in the food, or the products of fermentation or putrefaction of food in the stomach. The eructations may either be tasteless, possess the taste of the food eaten, or have a sour or bitter taste. There may be no taste, but the eructations may possess a disagreeable odor. We have been obliged to open our office windows at times when patients suffering from gastric cancer have brought up gas from the stomach, and still the patient complained of no taste but of the unpleasant odor, which was perceptible to him and exceedingly annoying. Fluid contents of the stomach may be brought up with the gas into the gullet and sometimes into the mouth. This belching may be noiseless or ex-

tremely noisy, and sometimes has a regular rhythm to it. Very often the patient insists on giving an illustration of it, and it has always occurred that this exhibition is of the noisy variety and usually puts the patient down as a neurasthenic. It may occur directly after the meals, or some time after, or often occurs with no relation to meals, particularly in the night time; when it takes place at this time, it should be ascribed often to cholecystitis. Patients declare that these eructations give relief, and attempt to provoke them either by compressing the stomach between the diaphragm and abdominal walls by taking a long respiration, holding it and pressing as at stool, or else by consciously or unconsciously swallowing air. This symptom may be found with all forms of gastric disorders from a slight indigestion to gastric cancer. Still, from some of the characteristics accompanying it we may often draw certain conclusions. If the belching is very noisy and the patient attempts to show how it is done, it may be regarded largely as a nervous affection (*eructatio nervosa*). When the eructated gas is tasteless or has the taste of the food, it is likely to be swallowed air, an accumulation of which in the stomach—often from hasty eating—causes the sense of fullness and pressure which is relieved by the belching. On the other hand, as we may learn from the x-ray picture, where the "stomach bubble" is almost always present, from the drinking of soda water and from the effervescing mixture used in physical examination of the stomach, the presence of considerable amounts of gas in the stomach may not cause discomfort. Hence we must find some conjoint cause for the discomfort, and this is probably an oversensitiveness of the stomach or a cramp of the same produced by the distention of the gas. In our own experience we have never found any distress produced by the use of sodium bicarbonate and tartaric acid for diagnostic distention of the stomach, but in Boas' clinic we have seen so much distress caused that it was necessary to introduce a stomach tube. The eructation of sour-tasting fluid from the stomach is usually associated with pyrosis, and is due to the same cause. Bitter eructations are due to fermentative changes in the gastric contents, when they often interchange with acid, or often to the presence of partially digested protein, which has, as is well known, a bitter taste. The patients, however, usually ascribe this taste to bile, and regard their livers as somehow at fault. Eructation with the odor of sulphureted hydrogen or rotten eggs, as it is often described by the patient, as before stated, is usually due to a malignant growth which has begun to break down. It is also probable that the reflux of intestinal gases into the stomach may be

the cause of a bad-smelling ructus, as it is often assumed by the laity, and such a reversed peristalsis has actually been demonstrated by the x-ray examination. Very often a foul breath may be associated with such eructations; the more disconnected with the taking of food this eructation may be, the more likely it is to be of a nervous character.

Vomiting.—This symptom has about the same causation as the nausea which has already been described. It is dependent on the irritation of the vomiting center, which may be aroused in many ways. It may arise from the brain itself when suffering organic or functional disease, such as the repeated vomiting sometimes noticed after a fall upon the head; or it may arise from poisoning, as the persistent vomiting after gas poisoning; or it may arise by reflex action from disease of some organ in the lower abdomen, as in the vomiting of acute appendicitis. The vomiting, too, often indicates its own significance in the manner in which it occurs, as in the nervous vomiting of neurasthenics, in hysterics, or in meningitis, in that the act is not connected with the taking of food and is not preceded by nausea nor pallor; the act follows, too, with great ease and is not accompanied by straining. It often occurs while the individual is fasting, as in the early morning, is very erratic, ceasing and recurring without any known cause, and one is often surprised, after being told that practically all the food is thrown up, to note how little effect it has had on the physical condition of the patients, since they often appear well nourished. We must always be careful, when the vomiting has the characteristics which have been mentioned, not to ascribe it to a functional nervous disorder, even though other symptoms are present, without thorough examination, for it sometimes turns out, as we have seen it in at least two cases, that the actual cause was disease of the brain, in one instance being tuberculosis and in the other a gumma, which unfortunately was not discovered until the autopsy. Sometimes we note that the vomiting is periodical, occurring at well-defined intervals, and associated with gastric crises, or accompanied with pain, as in tabes and other diseases of the cord, or with hemicrania in migraine; and attacks of gall stone and renal stone colic, accompanied by vomiting, may often assume considerable regularity in their occurrence. We have also a form of periodical vomiting in children, which was supposed to be due to acid intoxication on account of the presence of acetone in the breath and urine, but the probabilities are that the acetone is the result of the persistent vomiting and not its cause. This vomiting may also occur in young girls at puberty, often in con-

junction with the menstruation; or may be dependent on change of surroundings, as from an open air to an office life; or may be due to fright, as after a boisterous sea voyage, or sometimes to anemia. At times no adequate cause whatever can be discovered, but the most pronounced characteristic of this form is its persistence, resisting all our efforts at stopping it, its freedom from pain, and the beneficial influence of rest in bed and liquid food. The vomiting, which is often associated with uterine affections, is not of reflex nature, but is due to the effect of such changes on the nervous and psychic state of the patient as may, in its turn, be accompanied by vomiting, just as is true when the impaired nervous system is produced by any other cause; at least this is true of versions and flexions of the uterus, whose correction rarely checks the vomiting. When vomiting is caused by affections of the generative organs, it is usually produced by inflammation of the adnexa, combined with localized peritonitis, and the latter is the cause rather than the former. This is wholly apart from pregnancy, which is well known to produce emesis for a certain time, and many of the vaunted measures which are supposed to check it are usually employed at the period when it, a self-limited affection, is accustomed to cease. Vomiting accompanies other local inflammation of the peritoneum in connection with appendicitis, cholecystitis, etc., and has many of the characteristics of the nervous form—i.e., independence of taking food, etc. Furthermore, when the patient complains of vomiting, we must inquire carefully whether food fragments are present, for many have at times, and sometimes directly after food is taken, an excessive flow of saliva, which is often brought up by abortive efforts at vomiting in that food does not appear; this is variously known by the laity as "dry heaving" and water brash. Then, too, efforts to clear the throat in pharyngitis and cough produce real vomiting, as is noted in pertussis, and particularly in the old who are suffering from emphysema and chronic bronchitis (winter cough). We cannot accept unreservedly the statement of excessive smokers and drinkers that the morning vomiting is a symptom of gastric affection, as often there is an accumulation of tough mucus on the walls of the pharynx, which sometimes produces nausea and vomiting. The so-called "morning vomiting" of hard drinkers is more often of this nature, and the emesis is quite copious, since it brings up the saliva and mucus which have been swallowed during the night. This vomiting may, however, contain almost pure gastric juice in continuous secretion, or there may be fragments of food where a pyloric stenosis exists. In true gastric affections the vomiting occurs

after food is taken, and usually at a stated and very regular interval after that act. This is particularly true of a few affections like ulcer of the stomach, when vomiting comes shortly after eating at the conclusion of an attack of pain, or it may occur several hours afterward; at this time, too, we are likely to have the vomiting associated with hypersecretion, which is becoming more and more to be thought to be really caused by a chronic ulcer of the same organ. In gastric cancer the vomiting is common, but it may be absent during the whole course of the disease; it is much more common when the growth is situated at the pylorus and marked stasis is present, when the act takes place not often, but once in a day, yet enormous quantities are brought up, apparently without much of any effort on the part of the victim, on account of the enormous hypertrophy of the muscular walls of the stomach. Earlier in the disease, however, it occurs after almost every meal, usually preceded by an attack of pain and often by visible peristaltic waves. Later, when the growth at the pylorus has broken down, once more freeing the passage, or in all cases when a gastrojejunostomy is done—and here is the great value of the operation in this disease rather than a hope of cure—the vomiting ceases. In cancer of the body of the stomach, emesis is usually absent, and it may occur equally as well from any other cause producing narrowing of the pylorus and with the same characteristics as in cancer; in chronic gastritis and in dilated stomachs, provided there is little or no stasis, the vomiting has no peculiar characteristics.

Regurgitation.—Regurgitation, that act by which, without nausea or any effort, food arises by the mouthful in the mouth, and is either swallowed or spit out, should not be mistaken for vomiting, as it always is by the patient, who states that she—for I have found this act most common among women—vomits every mouthful she takes, yet looks very well nourished. This is found particularly among neurotics, and is said to be common among idiots. We have seen one well-marked instance in a sufferer from acromegaly, whose intelligence, though dulled, would not put her in the idiotic class. Then, again, it may occur in rather obese, tightly laced ladies who attempt to indulge rather strongly in the delights of the table. Furthermore, it is common in stenosis of the esophagus as well as in diverticula and dilatation of the same organ, and often requires a careful examination to determine whether the material regurgitated comes from the esophagus or the stomach, for frequently astonishingly large quantities may come from an esophageal dilatation. Rummation differs from regurgitation only in that the food brought up is swal-

lowed again instead of being ejected. Some patients say that, as long as the foods taste just as they did when first eaten, they reswallow them, but, when the material tastes sour or bitter, they spit it out. Again, the neurotics and those mentally deficient form the group to whom this act is common, yet, where such persons are grouped together, as in an insane asylum or home for feeble-minded, imitation plays a great part, for some individuals possess and others easily acquire the power to regurgitate at will, and on a former student who had this power many interesting experiments in digestion were tried. The anatomical basis for this peculiarity is not known, but it may be dilatation of the lower portion of the esophagus.

When the vomitus contains a large amount of fluid with food fragments, unless it comes immediately after a copious meal, it usually indicates a dilated stomach, accompanied and often caused by a narrowing of the pylorus. Large amounts of fluid, without food residue or with only mere traces of the same, may occur in hypersecretion or in gastric crises. In the former case hydrochloric acid is present, but in the latter we have often found it absent; in the vomiting of migraine it may or may not be present. Directly after a meal the vomitus has the same taste as the food; later it has a sour taste, and, if hypersecretion be present, it is often excessively acid. At a much later period of the digestion the taste may be bitter from fermentation, presence of peptones or often bile, if the vomiting be continuous; in putrefactive changes in the gastric contents (*sarcinae*) the patient also complains of the bitter taste of the vomitus. The odor of the vomitus may be like that of the food, or sour or rancid where there is fermentation, or even alcoholic; when putrefactive changes are going on in the stomach, it may have a putrid odor like spoiled meat, or, when there is obstruction or paralysis of the intestine, the vomitus may have a fecal odor, due to the indol present, and the act is often called fecal vomiting. The color of the vomitus depends largely on the character of the food taken, and it often requires a careful examination to determine whether undigested or digested blood (hematin) may not be mixed with it. Red wine, certain berry juices, coffee, and chocolate give the color of blood to the vomitus, and it may require the employment of a chemical test, if no account of what food was taken can be obtained, to determine whether the stain is due to blood. If such means are not at hand, it is much better to watch the stool for some time after the supposed hematemesis, which will almost certainly contain blood in quantities sufficient for a chemical test, than to accept the hemorrhage as having taken

place and make a diagnosis of ulcer. Bile which has remained some-time in the stomach imparts to it a dark-green color, sometimes termed black by the patient, while fresh bile, as produced by violent efforts at vomiting, gives to it a light-green or light-yellow color. Streaks of blood, when found in vomitus or when stated to be there by patients who are easily alarmed thereby, have no significance as indicative of a serious gastric lesion; they may come from the pharynx, mouth—particularly the gums, which bleed easily in some individuals—or even from the stomach, when the vomiting is violent, from the rupture of small blood vessels in its walls. When any considerable amount of blood is mixed with the vomitus, it gives the latter a very characteristic appearance, particularly if the hemorrhage has taken place slowly or the blood has remained in the stomach some time; then it has the color of chocolate or strong black coffee, and the well-digested minute fragments of hematin can be seen floating about or settling to the bottom of the receptacle, which are the "coffee grounds," so often described.

When the hemorrhage is excessive and vomiting takes place soon after it occurs, the red color of the blood may be retained, and this is also true when nosebleed takes place during sleep and the blood is swallowed; the presence of this in the stomach often causes nausea, and the bright-red blood is thrown up. The same is true of blood from the lungs, which is swallowed and then brought up, and it often requires a very careful examination of the lungs before this complication can be cleared up. The most common cause of gastric hemorrhage is ulcer. One observes it in cancer much less often because the latter may run its whole course without the erosion of a blood vessel which will cause any considerable bleeding. Bleeding may arise, too, from varicosities of the vessels of the stomach or esophagus, particularly in hepatic cirrhosis, or from the rupture of a small hardened artery of the stomach in arteriosclerosis. We must accept with considerable skepticism the vomiting of blood by hysterics and the vicarious substitution of gastric hemorrhage for menstruation without gastric lesion; it is probable that a concealed ulcer exists, or that simulation is practiced.

We have already spoken of the presence of bile in the vomitus when violent efforts at vomiting are made, and the same is true when vomiting occurs in a patient fasting, for then the pylorus is apparently open. In many cases the introduction of the stomach tube into the empty, fasting stomach for the purpose of lavage brings a certain amount of bile through the pylorus, even when no violent gagging

takes place. Continuous vomiting of bile-stained contents usually indicates a narrowing of the duodenum just below the outlet of the common duct, but in a case of duodenal kink recently under our observation, which was substantiated by operation, the vomiting usually occurred at night, and there was a large amount of bile-stained fluid, with much mucus, but no food fragments. In fact, mucus is present in fairly large quantities in all vomitus, but it may arise from that of the pharynx and esophagus which has been swallowed as well as from the saliva, the secretion of all of which is increased by nausea and the act of vomiting. The gastric mucus itself is also increased by this act, so that mucus in vomitus has no significance.

Nature of the Stool.—Disturbances of the intestinal function are almost always an accompaniment of diseases of the stomach. Generally, constipation is present. This symptom is often present, not on account of the illness itself, but on account of change of diet and conditions of life necessary in gastric disorders. Sometimes, too, diarrheas are present, which are due to irritation of the intestines by the products of disturbed gastric digestion, or because of the increased burden placed on the intestines by the insufficiently prepared nutriment which leaves the stomach. On this account one often observes diarrhea in achylia, where the albumen digestion in the stomach suffers most particularly. Such gastrogenous diarrhea occurs, since the undigested meat remnants furnish an excellent medium for the growth of numerous bacteria, and in this way encourage the putrefaction of the meat.

Flatulency.—This symptom, which is so common in gastric diseases, accompanied by meteorism and gaseous distention, is dependent largely on the same causes which produce the eructation—that is, abnormal production of gas by fermentation processes and by the swallowing of air. The intestinal distentions which are so common an accompaniment of the gastric distention are dependent on the necessary relations between the gastric and intestinal disturbance, especially on constipation and diarrhea, which are so frequently present.

Foul Breath.—This symptom is considered here because it is so often present in diseases of the stomach. It is mentioned not only by patients who suffer from gastric disease, but also by those who are free from any stomach disorder, as an unpleasant odor from the stomach, and always attributed to this organ. First, it should be mentioned that a bad breath is often only a subjective sensation produced either through psychic influence or oversensitiveness of the sense of smell. The real foul breath is, temporarily at least, noticed by others; some-

times the patients also are tormented by this difficulty. It is evident that this odor may be produced by purely local conditions, which arise either in the mouth and its neighboring parts, produced by stomatitis, pharyngitis, hypertrophy of the tonsils, caries of the teeth, alveolar abscess, pyorrhea, necrosis of the jaw, and ozena: It may also be present from disease of the lungs, chronic bronchitis, and bronchiectasis. A very common cause of bad breath, as is well known, is the lack of care of the teeth and the mouth; a further cause is an extensive coating of the tongue, especially when it occurs in connection with severe illness and as a result of insufficient alimentation, particularly where there is an insufficient ingestion of solid food. Gastric disease may be a direct cause of foul breath when fermentative or putrefactive processes are taking place in the stomach. Furthermore, one often finds a perceptible bad odor of the breath in some cases where no subjective digestive difficulties are present, where the examination of the stomach shows a perfectly normal condition, and where none of the above-mentioned causes are responsible. In some cases this symptom is so intense that the odor is not only perceptible in the immediate vicinity of the patient, but is also noticeable in any room which the patient may enter. It has been supposed that this may be due to the entrance of intestinal gases through the open pylorus into the stomach, or to the increased absorption of these gases into the blood and the transference of the same to the expired air. It is not to be doubted that gases may make their way from the intestines directly into the stomach, but in what conditions an increased absorption of intestinal gases may take place is uncertain. That constipation alone may play a part in this (as is sometimes supposed) is not probable, since, in spite of the great frequency of the former condition, a bad breath is not a common occurrence. On the other hand, one often observes in many persons afflicted with this symptom that the stools are regular and satisfactory. With persons who suffer with alternating diarrhea and constipation it is sometimes noted that during the period of diarrhea the odor disappears, to return with the onset of constipation; therefore, in the latter cases mentioned we are decidedly in doubt as to the cause of the odor.

It can be seen from the foregoing how necessary it is that we should not confine ourselves to the examination of the stomach alone, but should investigate the other organs of the body, as well as the nervous system, either before or in conjunction with a gastric examination. On the other hand, it can be easily realized that we cannot at all times investigate so thoroughly the history of the patient as in

the present regimen. It is sometimes equally important to allow the patient to give the history of his illness in his own way, and from the story thus given to deduce the more important symptoms and to make inquiry regarding each of these in turn. When, however, the cachexia of the patient leads us to suspect malignant disease, sometimes the discovery of a tumor in the abdomen may at once clear up the nature of the disease, particularly when it is confined to the epigastrium. An associated examination of the urine, too, will often be of great aid in the investigation of the digestive disorder by the discovery, for instance, of bile pigment, a strong Ehrlich reaction, or the presence of sugar due to pancreatic disease. The importance of a very careful investigation of the subjective symptoms of the patient is particularly necessary, since in so many instances of digestive disorders we are unable to obtain any tangible objective findings. In this very point lies the great difficulty in diagnosis of gastric disease in contradistinction to those of other organs. Furthermore, it must not be forgotten that the condition of hypochondria, which so often brings the patient to the physician on account of an entirely unjustifiable fear of an incurable gastric disorder, can often be overcome at a stroke by the assurance that there is no organic disease. This is a much better course to pursue than to put too much stress in conversation with a patient on moderate atony, dilatation, ptosis, etc., which often converts a mild neurasthenic to an exaggerated sufferer from conscious gastric disease.

CHAPTER IV

PHYSICAL METHODS OF EXAMINATION OF THE DIGESTIVE TRACT

INSPECTION.

We must first note the condition of nutrition of the patient, taking carefully into account the length of the illness. Rapid loss of flesh usually means a severe sickness, while the maintenance of a good condition, in spite of continued illness, means a mild disease. Next we must note the color of the skin; pallor of the skin or mucous membrane; cyanosis, with livid lips; the lemon tinge of cachexia; icteric and subicteric coloration, especially of the scleræ; all have their particular significance, which will be brought out later in the description of the examination.

Mouth.—We should note carefully the presence or absence of the teeth or caries of the teeth, and the condition of the tongue and pharynx. On account of the importance of mastication, special attention should be given to the teeth, for improper chewing of food produces disturbance of digestion, causes disordered functions of the stomach, and may lead to organic changes in the latter. Achylia is often noted in connection with faulty teeth. Furthermore, through lack of cleanliness of the teeth and decaying teeth a multitude of lower organisms enter the stomach, and by action on the food produce deleterious substances, which give rise to serious disturbances, and hence decaying teeth may be the cause of gastric disorders. It has already been noted that chronic pharyngitis may produce the morning vomiting, and therefore a careful inspection of the pharynx is always necessary. The tongue has long been supposed to be the mirror of the stomach, and from its condition we have sought to learn the state of the latter organ. With a heavily coated tongue, appetite is usually wanting, and this is especially true when the forward part of the tongue is involved, while, when confined to the rear part (as is often found in heavy smokers and drinkers), it has no significance. Many patients often preserve an excellent appetite, although the sense of taste may be impaired, and hence both portions of the tongue should be carefully inspected. It is a well-known fact that, apart from

gastric disorders, the tongue is coated in all acute and chronic disease, especially when associated with fever. The coating may also be due to an exclusive liquid diet, since through mastication of solid food the tongue is constantly being cleaned. As far as gastric diseases are concerned, the tongue is found heavily coated in all severe acute affections of the stomach—in chronic gastritis as well as in stasis with fermentation, and in cancer. The coating is usually absent in hypersecretion and ulcer, when a peculiarly bright-red tongue is often found. In gastric neurosis the character of the tongue so varies that little can be learned from it. As the disease vanishes, the coating usually grows less. Another particularly valuable thing in the inspection of the tongue is that the presence of a heavy coating excludes simulation of stomach disorder on the part of the patient. The tongue's coating is made up of desquamated epithelium and detritus, leucocytes, molds, and food remnants.

• **Anatomical Configuration of the Body.**—An inspection of the general build of the patient is of great importance, since at a glance we may detect the so-called "habitus enteropticus," which is usually associated with displaced abdominal organs and disturbance of digestion. This condition has been described by Stiller, who first called attention to it, in the following description: "It is usually found in the younger members of both sexes, with preference for the feminine. The nutrition is poor, the muscles undeveloped, the bones small, and the skin thin and pale; the clavicles and shoulder blades are very prominent, springing from a narrow chest, whose upper and lower apertures are diminished, and the epigastric angle is extremely acute; the tenth rib, on account of a defect of its cartilage, is shortened, and from lack of tone of its intercostal ligament is movable: the abdomen is flat, narrow, and its lower portion protrudes; the stomach is prolapsed, atonic, and the right kidney usually movable." This condition, according to the author, is congenital and often inherited. It manifests itself in the digestive apparatus in the form of enteroptosis, atony, and nervous disorders. It is often associated with chlorosis, tuberculosis, gastric ulcer, and orthostatic albuminuria. Such a condition as this we see often, but we also see many of these symptoms apart from this complex, and hence not dependent on heredity. On the contrary, many persons with this habitus may have good digestion, so that its value as a diagnostic criterion has lost something in the estimation of physicians.

Abdomen.—For a satisfactory examination, the patient should lie comfortably in a horizontal position. Where prolapse of the stomach

is suspected, an examination in the erect position is also of great aid. The abdomen should be looked at from the front and also from the side, with the light striking the patient preferably from the feet. The patient should breathe at first superficially, then deeper on request. We should note carefully striations, scars from operations, varicose veins due to obstruction of the portal circulation, and the edema of the abdominal walls. In the meantime the normal conditions are always to be borne in mind. In thin people the abdomen seen from the side extends but little, or not at all forward. The side lines seen from the front curve out slightly from the costal border to the pelvic ilia in man and considerably in woman, forming concavities in the latter. The recti can be seen to advance in the muscularly developed when asked to rise to a sitting position. On coughing, all muscles contract; by inspiration the abdominal arch increases and muscular contours vanish; by expiration the abdomen flattens out and muscular contours appear once more. In the obese all these distinctive features vanish. A layer of fat often reaching 10 cm. prevents even the costal borders from being seen; a cough causes only a general shaking of the abdominal walls. The tension of the abdominal walls is dependent on the fullness of the digestive canal or peritoneal cavity; as this fills, the walls relax. This is of valuable importance for palpation, since by reflex action the tension of the walls relaxes on full inspiration and sublying growths or organs can be more easily felt. The same conditions prevail where there is irritation of the digestive tract or peritoneal cavity, as local or general peritonitis. Then a lack of coordination between the tension of the walls and contents of the peritoneal cavity exists, and the diaphragm is forced upward, causing shortness of breath and labored breathing. Uniform enlargement or protrusion of the abdomen first attracts our attention. This may be due to the fat easily detected by palpation or to ascitic fluid, which may be detected by percussion in different positions of the body, and often by dilated veins upon the surface of the abdomen. Uniform enlargement is also often due to meteorism, caused by undue distension by gas, which often partially obscures the dullness of the liver. This is particularly true when the whole small intestine is distended. We may also have a peritoneal meteorism, which differs from the intestinal by presenting a perfectly equal and even enlargement over the entire abdomen, with a like tympanitic note and complete loss of liver dullness, which is rare in intestinal meteorism, except where paralysis of the tract is present. Apart from intestinal paralysis, we may have an almost regular protrusion where there is stenosis at the

colon flexures, sigmoid or rectum, leading to an insufficient ileocecal valve and general circulatory stasis, preventing the absorption of the gas, as in regurgitative heart disease, emphysema, cirrhosis, and hysteria. A partial enlargement or protrusion of a part of the abdomen may be due to the enlargement of an organ—for instance, the liver, spleen, etc.—or to a partial meteorism from stenosis of a part of the tract. This is not necessarily present in stenosis when sudden and acute, and, if present, is often obliterated by the reflex tension of the abdominal walls due to the peritoneal involvement. If the stomach is distended with gas from pyloric stenosis, the epigastric region protrudes, or, if the stomach is prolapsed as well as dilated, it may fill the whole left portion of the abdomen as well as the middle. Here there is presented a marked contrast between the concave epigastrium and the protrusion of the middle and left half of the abdomen, with the flattened right half. We can demonstrate that the enlarged portion of the abdomen is stomach by succussion sounds and view of the contour of the stomach, or the latter may be made more prominent by an effervescent mixture. Furthermore, a common cause of small protuberances is epigastric hernia, which appears as a diffuse or sharply defined protuberance in the median line, which may be single or multiple. The favorite site is above the navel—sometimes halfway between the latter and the tip of the xiphoid. The larger ones are readily seen, but the smaller ones require an especially good light and a view from the side. People often confuse them with lipomata or localized masses of fat; the former protrude more by coughing or straining than the latter. Real umbilical hernia may appear at the navel, or at this point there may be metastasis from other malignant growths in the peritoneal cavity. These have been observed by the author as a concomitant of primary cancer of the right ovary, associated also with secondary malignant disease of the great omentum. When the stenosis is situated at the sigmoid, the whole distention is in a transverse direction and in the right flank. When the obstruction is at the ileocecal valve, the meteorism causes a large distention of the middle area of the abdomen. When, however, embolism of the mesenteric artery takes place, as described in Chapter I, what is equivalent to a constriction appears above and below. We have a short length of distended gut, which is extremely tympanitic. This develops very rapidly, so that distention above the first constriction may not occur. In strangulated hernia a distention of the gut is visible through the abdominal walls. In this case the diagnosis is not difficult, especially when the enlargement appears above the usual orifices—viz., the navel,

linea alba, inguinal and femoral canal. Sometimes localized abdominal enlargements may arise from intestinal paresis in hysterical females, or perhaps from a spasm of a group of abdominal muscles.

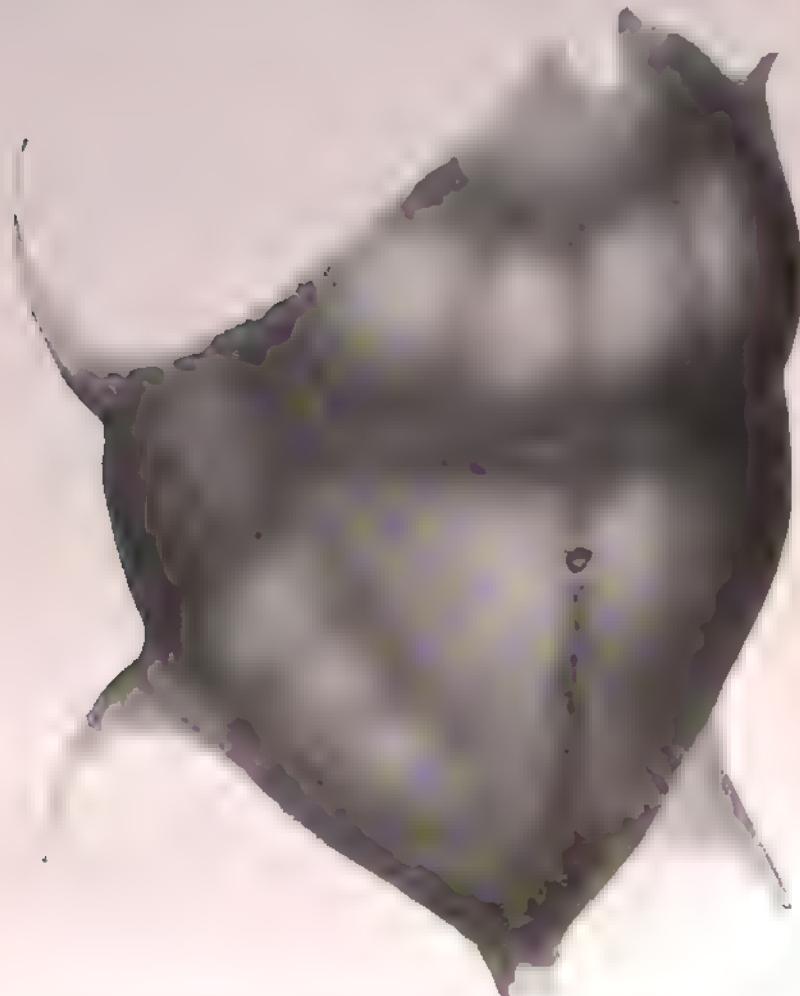


Fig. 9.—Stenosis in the vicinity of the splenic flexure (Nothnagel.)

This forms often the so-called "phantom tumor," and may be cleared up by relaxation of the muscles when the patient is asked to cough or to rise from a prone position, both these actions releasing the spasm of the muscles. Localized protrusions may be produced by

tumors of the intestinal canal itself, but by inspection alone such growths cannot be distinguished from gaseous distentions, although their character may often be suspected from their irregular outline,

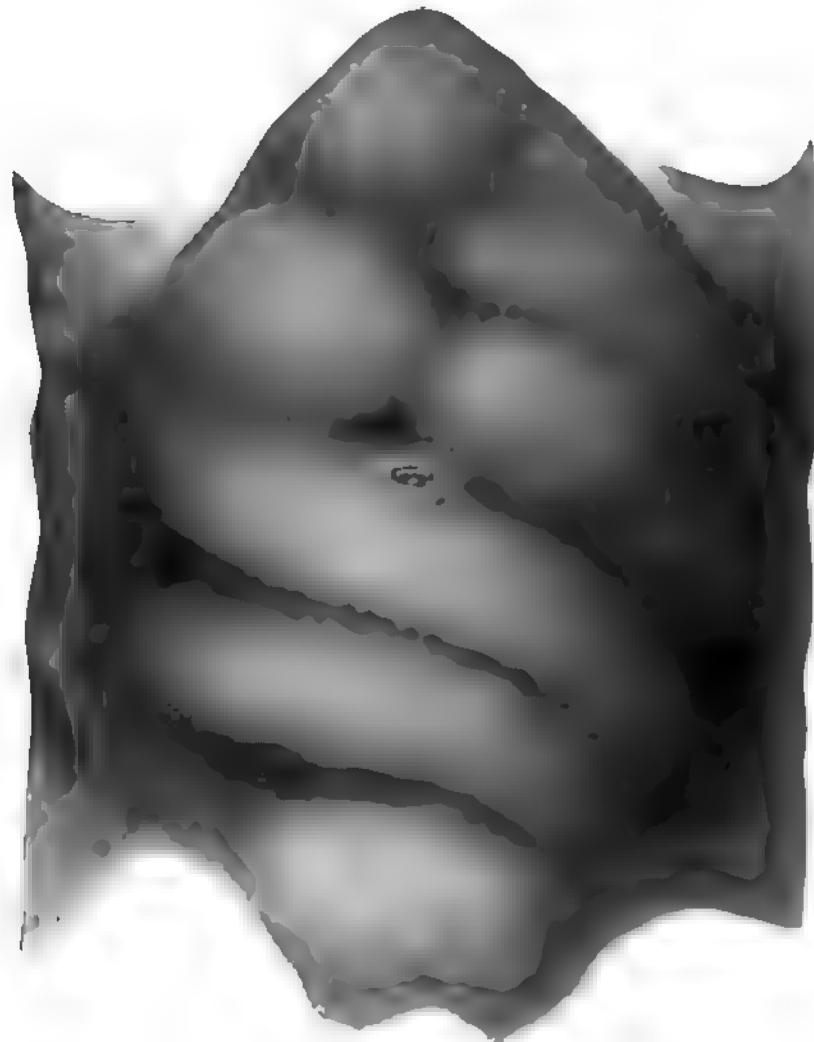


Fig. 10.—Stenosis of the lower abdomen from peritoneal adhesion. (Nothnagel.)

their motion with deep inspiration, and their special location, as at the cecum, or, as the author has seen, one in the descending colon, just above the iliac crest, which was malignant, and one of the sigmoid,

which was tubercular. As the diagnosis of abdominal tumors is one of the most difficult tasks which the physician has before him, the eye must be especially trained to notice the slightest unevenness in the contour of the abdominal level, since in this way attention may be attracted to pathological processes which otherwise might escape his attention. The diminution of the abdomen, which may display itself by flatness, prominence of the costal borders, with a rapid fall to the level of the navel, the so-called "canoe-shaped" abdomen, due to great emaciation, to cancer of the esophagus, or to tubercular meningitis, sometimes occurs. Under favorable conditions—that is, in spare persons with lax abdominal walls—one can see the lower border of the stomach when filled. With a moderate degree of prolapse, this is much easier, and often both borders (upper and lower) may be seen. When the stomach is dilated and the muscles hypertrophied, the stomach often stands out from the abdominal walls in its whole contour, like a molded raised figure; peristaltic waves can also be seen moving quickly from the patient's left to right side. These are very much intensified and exaggerated when stenosis of the pylorus exists. Very rarely in extremely nervous people we see the same thing, but ordinarily this increased peristalsis means a stenotic pylorus. Occasionally there may be seen an intermittent spasmodic tumor in the region of the antrum, the spasm of the pylorus, when cancer or ulcer is present. When the stenosis is marked and the muscular tone of the stomach normal or increased, contraction of the entire stomach below the costal borders (gastric rigidity) can be seen, which relaxes and alternates with the peristaltic waves. This can often be aroused by friction or dropping cold water from a height upon the epigastrium. Ordinarily, the peristaltic motions of the intestines are not seen. When, however, the abdominal wall is very thin, or diastasis—separation of the recti—allows the bowels to come in close contact with the skin, as in women who have borne many children, peristaltic action during digestion becomes perceptible. This is confined to the small intestine, and is found in the middle of the abdomen. Only short portions of the gut appear, are continually changing, and are never hard or rigid. Nothnagel compares their appearance to potatoes in a sack.

In nervous people intestinal movements, accompanied by loud noises, are visible. Pathological intestinal movements can be distinguished from the former by the fact that they can be seen through the normal abdominal walls, and even when the individual is very fat. They, like stagnation meteorism, when long continued and persistent, mean a narrowing at some point in the intestinal tract and hypertrophy of

the muscles above this point. In acute strangulation, they can be seen only occasionally, and never with the distinctness of chronic stenosis. Pathological peristalsis is not continuous, but periodic, for the muscles soon tire after a time. Here, again, friction or dropping cold water from a distance upon the abdominal wall may start them up. Accompanying these, one often sees a whole section—not short stretches, as in physiological peristalsis—raise itself above the level of the ab-

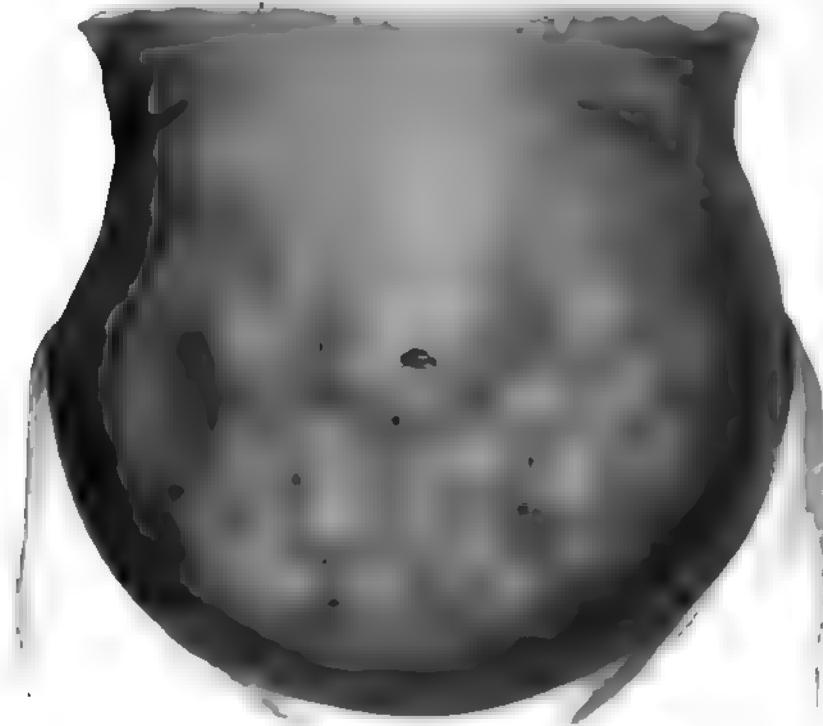


Fig. 11.—Normal intestinal peristalsis (Nothnagel.)

dominal wall and remain hard and rigid while a peristaltic wave passes through it—i.e., rigidity. This appearance is very much like a garden hose when water is first let through it. After a short time the rigid portion relaxes and sinks, with a loud gurgling tone as gas and fluid pass through the narrowed portion. This repeats itself again in the same or neighboring sections until the muscles of the intestine are exhausted. In distinction from the physiological peristalsis, this consists of rigidity and peristalsis of the entire section of

the gut. This rigidity usually occurs only in such portions as are distended with gas from stagnation, since it is a prerequisite that such inflation should be visible through the abdominal wall. Such an observation, no matter how long delayed, often clears up the diagnosis at a glance, and the author's revered teacher, Professor Oser, of Vienna, used to say that he had watched hours for such a phenomenon in a patient. With the intestine empty, similar contractions can be seen in lead colic and cerebrospinal meningitis, but in these cases the abdomen is concave, and they are not confined to any particular section of the bowel, but traverse its entire length.

PALPATION.

Sensation.—We may first employ palpation as a method of examination to test the sensation—that is, to learn whether a spontaneous painful sensation or a tenderness to pressure is over the stomach, or any portion of the intestinal tract, or elsewhere, as over the gall-bladder, kidney, etc. Almost every internist has his own method of the use of his hands and fingers for palpation. The author's own preference is for the use of the tips of all four fingers, slightly flexed, of the right or left hand indiscriminately, according to the position of the patient, although the author prefers to examine standing at the patient's right, with back to his head. It goes without saying that the person examined must lie on his back, with the knees slightly drawn up. When general tenderness is found in any locality, then the tip of the forefinger may be used for circumscribing this, or a percussion hammer may be employed for the same purpose, a sharp blow restricting the area more closely than the finger. It is not, however, so much the method as the thoroughness of examination of all localities—epigastrium to the navel, the right and left hypochondrium, the region around the navel, and the right and left iliac fossa. Both deep and superficial pressure should be employed. Schmidt has called attention to the fact that superficial tenderness may be caused by myalgias of the abdominal muscles, which will be discussed later more fully. The patient should breathe both superficially and deeply during the search for tender spots. If, in spite of protestations of painful sensations, no tender points can be found, and incidentally more attention be paid to facial changes expressing pain than to loud exclamations of the hurts of pressure, we must rely on the patient's history for the source of pain, or put him down as an exaggerator of doleful sensations. If a painful spot or region is found, it is our duty

to try to determine whether it is due to hyperesthesia of the skin of the abdominal walls or of a deep-lying organ, or both. Occasionally a dermal hyperesthesia may arise from disease of the abdominal organs. Extreme tenderness of the skin can be demonstrated by raising a fold of the skin and pinching it lightly. This close relation between dermal hyperesthesia and disease of the abdominal organs has often been maintained, but for all practical purposes marked sensitiveness of the skin, which is not particularly circumscribed, means a neurosis and not a disease of the organs below. It often happens that no part of the surface of the abdomen can be touched without expressions of pain on the part of the patient, while, if attention be distracted, deep pressure produces no outcry. It is one of the greatest faults of physical examination to continue asking the patient, while palpating a certain part, whether it hurts, because, his attention being drawn to that fact, if he desires to impress the physician with the severity of his case, every pressure is declared to be painful. Again, we must call attention to the frequency with which the recti are painful to pressure, as described by Schmidt, simulating tenderness over an organ. The restriction of tenderness to these muscles can often be assured by grasping them between the fingers without exerting pressure on the parts underneath; when they are touched brusquely, pain is produced, but by trying pressure gradually we may exercise considerable force without causing discomfort. We may also by careful palpation detect an epigastric hernia, invisible to the eye, which may be the cause of pain in the stomach region. When pain is elicited by pressure, and we are assured it is not superficial, we must endeavor to determine whether it rises from the stomach, gallbladder, or kidney, as the pyloric portion of the first lies in close juxtaposition with the latter two. When the patient speaks of spontaneous pain in the epigastrium, particular attention must be paid to palpating the region of the appendix and, in women, of the uterus and adnexa, for disease of these organs often manifests itself by pain in the stomach region. Most commonly, pain on pressure is elicited in the epigastric triangle, bounded by a horizontal line connecting the cartilages of the ninth ribs and the costal borders from this to the end of the sternum. At the middle of this base, or a little to the right of it, is the "epigastric pressure point," which corresponds to the celiac ganglion.

Although the epigastric pressure point lies usually in the region of the stomach, even in ulcer of that organ it may lie outside its borders, as demonstrated by the radiograph. In such case it has been demonstrated that by change of position of the stomach, by full inspiration,

etc., the point does not change its site, and hence does not properly belong to the stomach; in fact, recent investigations have shown that in ulcer and neurosis the point lies outside of the stomach, while in other diseases, like cancer and perigastric adhesions, it belongs to it. We have all noted at times a tenderness, or hyperesthesia, extending downward from the epigastrium to the navel, along the course of the abdominal aorta. This generally means a neuralgia of the nerve plexus surrounding the aorta, but at the same time we must recognize that it may be due to disease of the stomach, particularly chronic ulcer, or some other abdominal organ. It demands a most

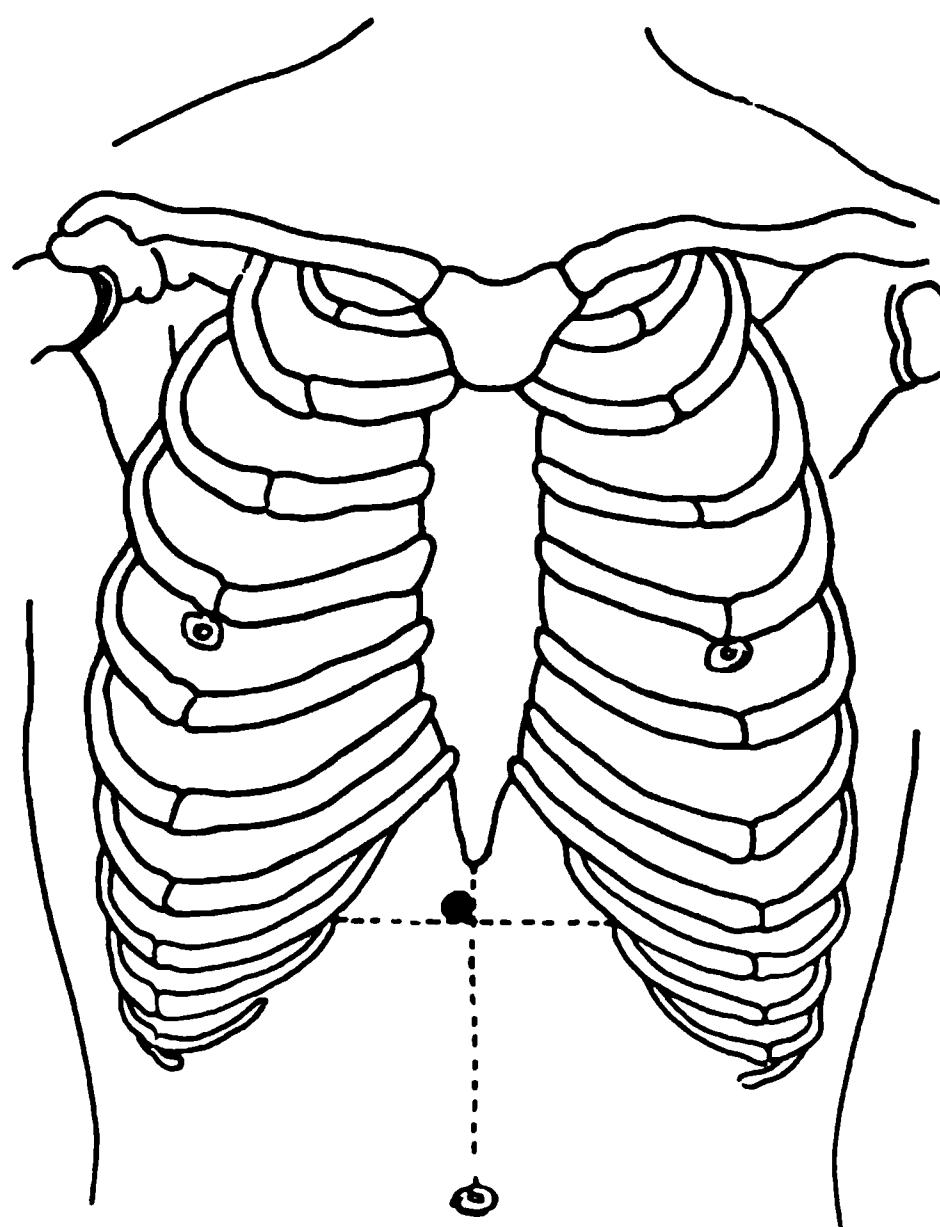


Fig. 12.—Epigastric pressure point.

careful examination to differentiate a neurosis of the celiac plexus from this condition, and often only a long observation of the patient will clear up the problem. Many a so-called cure of chronic ulcer based on this tenderness has really been a recovery from a neuralgia of the sympathetic plexus arising from a general neurosis. Attention must also be called to tenderness over McBurney's point—that is, a point where a line from the right anterior superior spinous process of the right ilium to the navel cuts the outer border of the right rectus muscle (a little outside of the middle of this line). This tender spot is generally regarded to be significant of inflammation

of the appendix, but, as the latter often changes its position, the tender spot associated with its inflammation is not always here; furthermore, tenderness at this point may accompany disease of the ureter, or Fallopian tube on that side, or colitis. The actual source of tenderness at this point, as stated before, is a nerve plexus lying upon the psoas muscle, which is irritated by all these diseases of neighboring organs, and therefore it is very unwise to make a diagnosis of inflamed appendix on tenderness alone at this point. Sometimes the tenderness will disappear on bimanual examination, with one finger in the rectum, which rules out the appendix, since, if sensitive, such an examination would increase it. If the appendix itself can be felt (which rarely happens) and is found tender, it clears up the diagnosis at once; raising the extended right leg helps palpation of this region considerably. Percussion, too, as stated, may be called to our aid to verify and localize tenderness. When, with fully relaxed abdominal walls, the epigastrium be tapped lightly with a percussion hammer, the most sensitive patient makes no complaint if the stomach and adjacent organs are free from disease. When, however, a gastric ulcer exists, which may be chronic and of long duration, a point is reached where the lightest blow causes pain, which lasts for some time after. Now, percussing outward in radial lines, a marked area of tenderness is found, with the first point as its center, and outside of this area no discomfort is experienced. These blows are supposed to shake the ulcer surface, whether directly under the blow, to the right, or even on the posterior surface of the stomach. Mendel believes that percussion is particularly valuable in detecting an ulcer of that portion of the stomach which does not lie against the abdominal walls. In the author's experience the percussion has a value in excluding ulcer where there is an undefined epigastric tenderness of pressure by the fingers, but the hammer fails to elicit a painful sensation. Schmidt calls attention to the variability of this painful spot produced by percussion, which he regards as dependent on the degree of distention of the stomach. Percussion over the tip of one finger, where a hammer is not at hand, may be used for the demarcation of the area of tenderness. This percussion tenderness is said to differentiate between hyperesthesia and true gastric disease, and, if the point of greatest tenderness be determined by increasing the blows, then the spot marks the site of an ulcer or a cancer, even when the latter cannot be palpated. There are various other pressure points in the abdomen, of which mention has been made in Chapter I. When tenderness is found at any of these points, it is sometimes most

difficult to distinguish between a hypersensitiveness through neurosis and hyperesthesia by reflex action from a diseased organ. The best way is to try each point in turn—epigastric, McBurney's, mesentericus superior (navel) and inferior (point corresponding to McBurney's in the left iliac fossa); if all, or the majority, of these points are tender, we may exclude organic disease. Besides all these, there are tender spots in the back, under certain conditions, to which Boas has called attention. For instance, in gastric ulcer there is one just to the left of the spinal column and just below the twelfth rib at its attachment to the vertebra; sometimes this is a little higher and some-

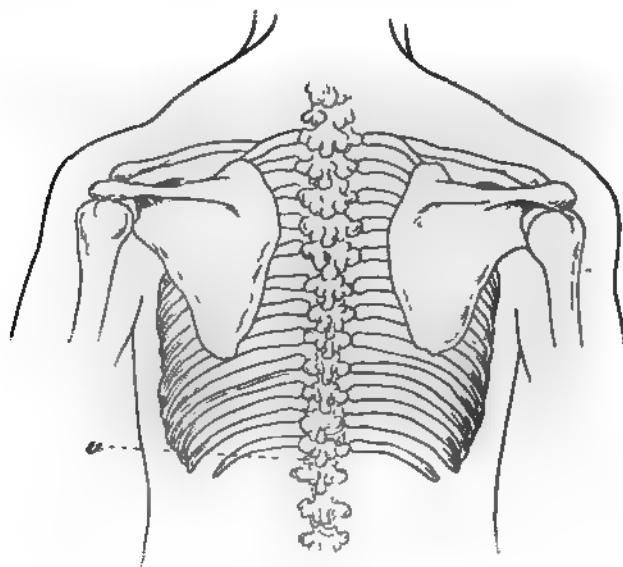


Fig. 13.—Dorsal pressure point in gastric ulcer, indicated at *a*.

times lower, and is not due to hyperesthesia, for the tenderness does not appear except on deep pressure. On the other hand, the tender area due to cholelithiasis lies on the other side of the spinal column, extending upward from the twelfth rib at its spinal attachment three fingers' breadth and an indefinite distance to the right.

In gastric neurosis, while the back may be tender, there is no regularity in the location of the tender spots. Naturally, the multiplicity of the sites and the varied intensity of gastric ulcer, together with the presence or absence of perigastric adhesions, so modify these tender points that it is not surprising that sometimes they are absent, but, if found, they are a great aid to diagnosis.

Palpation of Parts of the Normal Intestinal Tract.—As applied to the stomach, this method is important in determining the outline of that organ, as well as in detecting whether a tumor is attached to the stomach. When, for instance, there is marked emaciation and a canoe-shaped abdomen, which may arise from stenosis of the cardia, it has been claimed that the pylorus may be felt. This appears under the fingers as a cylindrical body, 2-7 cm. above the navel, either lying horizontally or diagonally, with one side directly upward and to the left and the other downward and to the right, as large as the finger or thumb, and of the hardness of cartilage. Under the fingers it

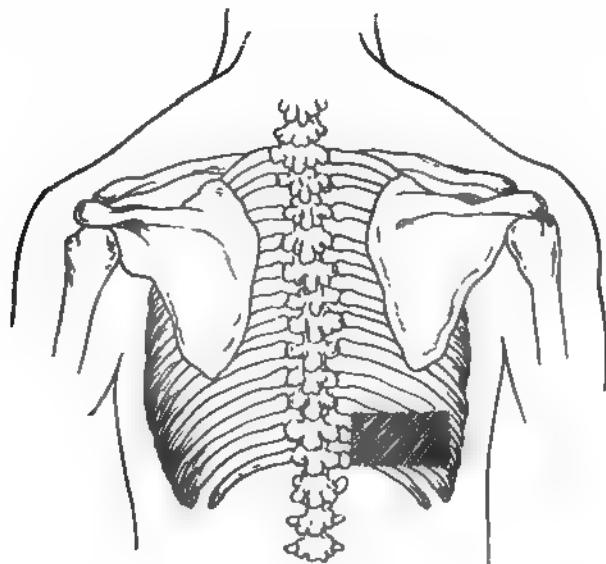


Fig. 14.—Dorsal pressure point in chololithiasis.

often collapses with a gurgling sound, and, instead of the cylinder, nodules are sometimes felt. The author's experience has been that, while with gastropotisis in women whose abdominal walls are very much relaxed a point may be found where by the sound heretofore described, aided by a sense of touch, one is assured that fluid is passing in well-regulated spurts, indicating the pylorus, his fingers have, however, never been able to grasp it fully. This fluid, as can be readily demonstrated, is passing from left to right in contradistinction to the course of the colon. It is evident that the pylorus is in a state of contraction to produce his phenomenon, for in the empty stomach, when it is collapsed, this sensation is almost never experienced.

Hausmann has given certain directions for carrying out this effort to feel the pylorus and other parts of the intestinal tract, which he calls deep palpation. It consists in first obtaining complete relaxation of the abdominal walls, which Schmidt declares can be best obtained by asking the patient to press his head into the pillow as hard as possible while lying on the back, thus putting the back muscles on the stretch and relaxing the recti, which prove such a hindrance to deep palpation; two finger tips (second and third) are then placed between the median line and the right costal border, and by pressure forced downward until they reach the posterior abdominal wall, reinforcing the pressure, if necessary, by the other hand passed over the palpating fingers; then a gliding motion downward is imparted to the lower hand. If anything is felt, we try to note its consistency, its movability by inspiration and its fixation by the hand in expiration, the acoustic phenomena described above, and its size. In this way the colon can often be felt as a firm cord lying above the navel, which is very important for the detection of the lower border of the stomach, and can be distinguished from the pylorus by lack of change of consistency, by the distance downward to which it can be passively displaced, and by its greater distance to the right of the median line, to which it can be followed. In a similar way the lower border of the stomach can be felt just above the colon as a ridge directed toward the feet, which recedes from the fingers on expiration. This ridge or band differs from the colon and pylorus in that no upper border can be felt as can be in the last two mentioned. In addition to this point, attention has also been called to "expiratory gurgling," which can be elicited by palpating the greater curvature, provided that there is fluid in the stomach and that the palpating finger be pushed until it meets the spinal column. Another point to distinguish between the stomach, colon, and pylorus is that the latter two can be "fixed"—that is, held during expiration—while the stomach cannot, since it is impossible in a normal stomach to reach its upper border because it is under the costal arches. This statement does not, however, eliminate the possibility of holding tumors of the greater curvature under these conditions. In case of any doubt, whether we have a contracted collapsed stomach or the colon under our fingers, it is only necessary to inflate the stomach with an effervescent mixture to clear up the matter, as a distended stomach bears no comparison to the colon. After all is said and done, mistakes will occur, even when the greatest care is employed, as in one of the author's cases, where the suspected pylorus, on account of its horizontal and lengthened con-

tour, turned out to be the lower border of a gallbladder containing three stones. True it is that the upper border could not be felt on account of the spasm of the muscle, but the stomach was clearly a prolapsed one, and the position of the gallbladder was not inconsistent with the suspected pylorus. The pancreas is probably never felt, except in very extreme cases of emaciation and relaxation of the abdominal walls. The author's experience is limited to only one case, which was a marked instance of splanchnoptosis, accompanied by periodical attacks of pain, followed by mild jaundice, in which there was a certainty that the pancreas was under his fingers. Its lack of movability by respiration, our inability to change its position by manual manipulation, its freedom from change of consistency, and acoustic phenomena protect us from mistaking it for any other organ. During digestion, however, the physiological contractions of the antrum pyloricum give the examining finger the impression of a cylindrical body lying to the left or across the median line, at varying distances above the navel, which has been mistaken by the author for the pancreas, but in a short time relaxation occurs and the mistake is self-evident. It is sometimes difficult to determine whether we are dealing with a pathological contraction or spasm of the pylorus because contractions follow each other with such rapidity that apparently no relaxation takes place. When, however, a continuous contraction of over a minute's duration, with a hard, rigid cylinder, exists, easily perceptible to touch, the pylorus is undoubtedly in a state of abnormal spasm. E. Schuetz does not believe that such a spasm can arise from pure hyperacidity, or, as we prefer to call it, hypersecretion, but must arise from some organic changes in the pylorus itself or in its neighborhood. This spasm of the pylorus, too, may be accompanied by pain, under which condition it is usually due to ulcer, or it may be painless as the result of malignant disease. Apart from the transverse colon, whose palpation has been described, many other portions of the intestine can be felt—the cecum, with the attached portion of the ascending colon, the descending colon, and less often the sigmoid on account of its changing position. The hepatic and splenic flexures cannot be felt because covered by the costal arches. The small intestine, too, eludes palpation in its normal condition. The palpable parts of the large intestine appear to the finger as a more or less firm cord, whose thickness depends on its content and degree of contraction. To the novice this appears like a pathological condition, since the more contracted it is the more perceptible it becomes. If, however, the palpating finger is allowed to

remain in contact with this cordlike body, sooner or later it should be felt to relax, the rigidity disappears, and there occur gurgling sounds on movements of the finger. It is very rare that the whole colon is found in this state of contraction, but the latter is confined to localized sections. It has been demonstrated that palpation of the intestine produces no unpleasant sensation, provided it is free from disease. The surface of the colon always feels smooth, except where scybala, as sometimes occurs, are present in the sigmoid, descending colon, and occasionally in the transverse. A special indication of these fecal masses is their compressibility and the sudden separation of the intestinal wall from them when the finger is slowly withdrawn. The existence of the latter peculiarity is doubted by some physicians, and in a busy clinic it is often more satisfactory to note the point at which the masses are found, and to send the patient away with advice to take a good dose of castor oil and to return in a couple of days, when sometimes, much to one's surprise, the masses have disappeared, thus proving their fecal origin. The most difficult factor in palpation of sections of the intestine is to determine whether the contracted portion that is felt is pathological, or if the distended, apparently atonic, fragment is abnormal. The röntgenologists have shown us so often contracted portions of the intestine in one picture, containing practically none of the bismuth mixture, which are amply filled in the next, that our indecision is not to be wondered at. When, however, our eyes observe a permanent meteorism and rigidity before the section of the intestine which is palpable, there can be no doubt of a pathological narrowing.

Palpation of Tumors.—Here we must distinguish between true tumors, occasioned by real anatomical diseases, and pseudo tumors. The latter, again, can be divided into apparent tumors, which do not give us the impression of anatomical or functional pathological changes, and phantom tumors, which are due to functional pathological changes. An apparent tumor is often the result of a contraction of the recti, by which there is a protrusion of a mass of muscle lying between two adjacent lineæ transversæ, especially in the upper portion of the abdomen. These are not mistaken only by beginners for pathological new growths, and, while they usually appear in nervous individuals at the first examination, in one case under the author's observation the spasm persisted up to the time when the muscle was relaxed by anesthesia at the exploratory operation, which disclosed, on opening the abdomen, a chronic gastric ulcer, which was not connected in any way, either by locality or adhesion, with the

masses which had been felt. Apart from these local contractions of portions of a muscle, we may have true spasms of the recti, the real phantom tumors, in nervous and hysterical persons with exaggerated reflexes. These spasms may be spontaneous or brought about by the lightest touch on the abdominal wall, or, they may result from actual disease of the central nervous system. Such spasms of sections of the recti, which actually overlie diseased painful organs—like a stomach with ulcer or cancer, an inflamed gallbladder, or any inflamed appendix (defense musculaire)—may occur. About the only way to differentiate the latter from the purely nervous spasm, or to investigate the organ underneath, is to examine in forced inspiration or in a hot bath. We often, while palpating, especially with very relaxed abdominal walls, come upon the aorta, but its course and pulsations keep us from error, though we must remember that a growth attached to the pylorus often lies upon the aorta, whose pulsations are imparted to the tumor. The true tumors of the stomach, on account of their great mobility, may be found in almost any part of the abdomen, R. Schmidt reporting a case of gastric cancer where the mass was found under the left costal border, yet most of them are found in the area bounded by the costal arches and the transverse umbilical line. They may, however, lie even below the navel to the right or left of the median line. The position of such a tumor is dependent also on the state of fullness of the stomach; for instance, a mass may be found well to the left of the median line when the stomach is empty, but after a meal, or on giving an effervescent mixture to inflate the stomach, the mass will be found well to the right—at the usual site of the pyloric tumor. It is well to remember that the pylorus and lesser curvature are the usual sites for both cancer and ulcer. It is often very difficult to determine by palpation the size of the growth, since the portion that can be felt is dependent on the state of relaxation of the abdominal muscles, the region of the stomach in which it is situated, and the amount of contents contained within it and the neighboring intestines, and for these various reasons it seldom happens that tumors can be wholly grasped. The most satisfactory examination in the author's experience was in an elderly man, through whose upper abdomen there was a huge hernia, resulting from a gallstone operation of ten years before, and in this pouch, undeterred by the rectus, a tumor of the pylorus could be grasped, entirely encircled by the fingers, and moved in almost any direction. All the other accompaniments of a gastric cancer were present in this elderly man. Under ordinary conditions, then, it is not surprising

that many gastric tumors evade palpation, and this is particularly true of those near the cardia, posterior surface, and lesser curvature of the stomach. These tumors, if malignant, usually have a hard, firm feel, like cartilage, and are roughened and granular to the touch, though they may sometimes be smooth. Those tumors caused by callosus ulcers, or by perigastric adhesions accompanying ulcers, may have all grades of consistency and roughness. They may feel smooth or granular, flat or cordlike; in fact, the mere attachment of a growth to the stomach gives one no information as to its character. Most tumors of the stomach are characterized by extreme tenderness on palpation, except the pyloric spasm dependent on cancer, which, as stated, may prove entirely free from sensitiveness. In most cases gastric tumors show a surprising amount of mobility, which can be demonstrated by change of position on the part of the patient, distention of the stomach by effervescent mixture, or displacement by manual manipulation. This is especially true when they are attached to the pylorus or the greater curvature in a low-lying stomach, as is its usual position under these conditions. Those, too, which can be moved about with the fingers show a remarkably spontaneous change of position with the ordinary peristalsis of the stomach entirely apart from its state of fullness; in fact, they may sometimes entirely disappear. Furthermore, this class may be recognizable only in certain positions of the patient, as lying on the left or right side, or in erect position, etc. When the tumor, as often happens, becomes adherent to neighboring organs, like the pancreas, liver, or intestine, its mobility may be lost. The gastric tumor may also show marked change of position with the different stages of respiration when the prolapse of the stomach has not gone so far as to separate it too far from its juxtaposition to the diaphragm and its consequent participation in the movements of the latter. This respiratory change of position of the growth is more marked the nearer it is to the diaphragm, so that tumors of the smaller curvature possess this quality in a marked degree, while those of the greater curvature or the pylorus are less susceptible to change of position, unless the pylorus becomes adherent to the liver, when this quality is restored to it in its fullest extent. When the tumor can be grasped by the fingers from above, it can be held in any stage of the expiration, and hence our inability to hold it fast is only secondary to our inability to get our fingers above it. R. Schmidt remarks that it augurs ill for the athletic prowess of the examiner if he cannot hold such tumors fast in expiration, provided he can only get his fingers above them. This quality is often

of great value in distinguishing growths of the liver and gallbladder above which one cannot get his fingers—that is, they are not susceptible to expiratory fixation—and those of the stomach, over which one can place his fingers. Still, when gastric tumors become attached by adhesion to the liver, they lose this quality, and some pyloric tumors never possess it. On inflation of the stomach, as previously stated, the position of the tumor attached to it changes its position very decidedly. The pyloric variety move from the left toward the right, and, in some cases in the author's experience, completely across the median line and downward. Those of the lesser curvature, since the stomach turns on its transverse axis, become less distinct and sometimes entirely disappear. Tumors of the posterior wall entirely disappear, and those of the anterior become more prominent. As to the character of the gastric tumor when discovered, whether benign or malignant, palpation gives us but little aid unless metastasis can be found. A callous ulcer, with more or less adhesions, will give the same impression to the examining finger as a cancer; in fact, even when the abdomen is opened, it is not easy to differentiate without a histological examination of a section. In two instances, to the author's chagrin, such masses in individuals over 50 years of age, with marked emaciation and visible, palpable gastric rigidity, have been pronounced malignant, operation refused, and life prolonged for three years to his knowledge, though pyloric stenosis persisted, with a fair share of health. In the effort to determine whether a mass attached to the stomach is a benign or malignant growth, we should never neglect the palpation of the inguinal, umbilical, or supraclavicular region, particularly the left, for enlarged glands. When cancer of the stomach exists, these glands are enlarged and hard from the formation of metastases, and such evidence has a great value both from a diagnostic and prognostic point of view. The inguinal and clavicular glands are, however, only rarely enlarged in gastric cancer, and may be involved from malignant disease of other abdominal organs, or even in other diseases, so that this diagnostic point has its limitations. The enlarged umbilical glands consist of several hard, isolated kernels, as large as a pea or hazelnut—either above or below the navel, or surrounding it—which is the usual appearance. We may, however, observe a very hard, firm infiltration of the entire navel, completely obliterating its contour, which is the much less common form. Unfortunately, both forms of involvement come so late in malignant disease that we can usually make the diagnosis without their aid. More recently attention has been called to the enlargement of glands in

Douglas' pouch in those afflicted with gastric cancer. These are found on the anterior wall of the rectum, above the prostate in man or the uterus in woman; furthermore, they may assume an annular form, even at times causing stenosis. These, if found, are a great aid where the gastric growth cannot be palpated, and their presence, of course, precludes the advisability of operation, unless undertaken for purely palliative purposes. After searching for these glands, in every case of gastric cancer coming under the author's observation, his opinion is that they are extremely rare. Again, it rarely happens that metastasis may be found in the right or left ovary, as in one case of the writer's, where the right ovary was involved. Meanwhile, tumors of neighboring organs, like the gallbladder, may simulate very closely a gastric growth, and can be differentiated only by inflation of the stomach or the x-ray picture. Particular care should be taken not to mistake an epigastric hernia for a gastric tumor. These small protrusions, rarely larger than a bean or a grape, are especially distinguishable by the fact that they can be replaced wholly or partially by the finger. In fact, in the prone position they often spontaneously disappear, to reappear on coughing or bearing down as at stool; if, during this act, one attempts to press them back, a peculiar crackling sensation is imparted to the finger, much like the pleuritic or peritoneal rub. This is apparently due to forcing the uneven surface of the hernia by the sharp edges of the opening into the contracted fasciæ of the linea alba. These hernias can often be detected only when the patient is in an erect position. Such a small, insignificant protrusion must be reckoned with when patients complain of painful sensations in the epigastrium, for they exert a deleterious effect by pinching a bit of the peritoneum or adjacent nerves, or, reflexly, by keeping up a gastric neurosis. Many of them are, however, discovered accidentally when no gastric symptoms are complained of, as in emphysema, where there is an almost constant inefficient cough. Furthermore, one should never be satisfied with the mere discovery of such a hernia without employing all other means of examination for other possible causes of gastric distress. It will not do to leave this subject without speaking of the possible association as cause and effect between the small ruptures and gastric ulcers. This connection is claimed by many as having been established. Of course, on account of their frequency, there must be many occasions where they are present together with an ulcer, but in the writer's experience their coexistence has been only a coincidence. It is much more reasonable to suppose that the weakness of the fascia is congenital,

and that the hernia appears as a result of increased intraabdominal pressure due to persistent cough or heavy lifting. Then, again, they often become visible and palpable through rapid loss of flesh, though they may have existed for many years. Mobility of a tumor in the intestine, is largely dependent on the segment involved and its relation to the mesentery, provided that no adhesions have formed; hence tumors of the small intestine will be more movable, while in the colon only those growths of the sigmoid and transverse colon will possess this characteristic to any great extent. Tumors of the duodenum, transverse colon, and both colic flexures may possess a moderate amount of respiratory motion, but those below the navel do not possess this to any great degree.

PERCUSSION OF THE GASTROINTESTINAL TRACT.

While it is true that percussion of the empty stomach, particularly if it contains no air, is futile, because in its collapsed condition, if normal, it recedes under the left costal border and liver, still, unless the patient has undergone a long period of fasting, or there is an esophageal stenosis, there is usually enough air in the stomach, swallowed with the previous meal, to give fairly good outlines on percussion, except along the upper border. These outlines are still more accurately defined when there is a moderate distention from food. This can also be exaggerated by moderate filling of the organ with air by a compression bulb or with carbon dioxide by means of the effervescent mixture. The filling of the stomach with fluid (drinking one or two glasses of water) and determination of the lower border by percussion, with the patient in the erect position, have also been recommended.

Method.—It is always best to have the patient on the back, because the abdominal muscles are better relaxed, and the use of the finger is to be recommended, since a much lighter blow can be struck with it than with the percussion hammer—a matter of no little importance when we are trying to distinguish the slight differences in tone between the colon below, or the small intestine to the right, and the stomach. For this purpose the finger used as a pleximeter should be applied very lightly to avoid the tone of deep-lying organs. Beginning at the fifth rib, one should percuss downward on the left side of the patient in three parallel lines—the parasternal, midclavicular, and anterior axillary—marking with a pencil the upper and lower limits of the gastric tympany, a note easily recognized; then, beginning below the level of this line, marking the lower border and extending to

the right, percuss upward and toward the left in converging lines until the right border of the stomach is delineated on the skin with a pencil. For reasons previously stated, it is impossible to mark out the upper border of the pyloric portion of a normal stomach, and the left border similarly eludes us. In the majority of cases this method gives us the desired information, but occasionally it is almost impossible to detect any marked difference in the tone while we are percussing over the stomach and the adjacent air-filled organs, and in this extremity we proceed to inflation of the stomach by means of air introduced through the stomach tube, during which we can either watch the distending stomach or ask the patient to make a signal when pressure begins to be felt, or we may give the effervescent mixture, to which reference has often been made. This consists of four grams of tartaric acid, which is to be dissolved in half a glass of water, and drunk by the patient, with some sugar (if the acid taste is objectionable, as it sometimes is); and then in a second glass five grams of sodium bicarbonate, also dissolved in half a glass of water, is to be taken either at once or in two portions, with an appreciable pause between, so that the stomach shall not be too suddenly distended. After this the patient should be encouraged not to allow the gas to escape by belching, and should lie down at once for examination. In the clinic one learns to shake out of a bottle into a glass practically this amount of the two powders without the necessity of weighing, or may use a level teaspoonful of each; at least no disadvantage has ever arisen in the writer's experience from using a trifle too much of this mixture, though theoretically, with weakened gastric walls (ulcer or cancer), such procedure might cause a perforation, but in these very cases, particularly on account of probable stenosis, it is unnecessary to employ it, since the stomach is usually well distended. It is not advisable to attempt to use the effervescent mixture in a fasting stomach, for the pylorus is relaxed and the gas readily escapes into the duodenum. The best time is shortly after a light meal, like the ordinary breakfast. This medium dose of the two powders is to be recommended rather than larger—which latter overdistend the stomach, produce a false picture, and are not wholly harmless—or smaller ones, which are perfectly useless for the purpose intended. Both these methods, and the x-ray picture of the stomach after the bismuth mixture, have their adherents, but the former is much less likely to produce bizarre, untruthful outlines, since it distends the organ in all directions, while the latter, by its weight, distends the most dependent portion. Furthermore, the distention with

gas, if the amount is not too great, gives exactly the same outlines of the stomach that are obtained by other methods, and one can often by sight alone determine the borders as accurately as by percussion. It is rare that a patient complains of any discomfort beyond a feeling of pressure. Only twice has it been the writer's experience to have patients complain of pain and nausea—one a condition of marked adhesions about the pylorus, and the other a gastric cancer with involvement of the omentum. Both conditions were confirmed by operation—the latter without the writer's consent. The pain complained of is usually described as similar to that which spontaneously occurs, an excellent proof that it has its origin in the stomach, and may be due to adhesions, as described above; to irritation of an ulcer, or to other inflamed condition of the mucous membrane; to spasm of the antrum or pylorus, or to neurosis, in which case any procedure, such as light percussion or gentle palpation, causes exclamations of pain. When such painful sensations are produced, it is usually only necessary to have the patient sit up, when the accumulated gas escapes with an explosive sound; if not, the introduction of the stomach tube (which should always be at hand) merely into the esophagus allows the gas to escape, which is followed by immediate relief. The only circumstances under which such inflation is prohibited is an active ulcer—that is, recent hematemesis. The inflation of the stomach with air has never proven very satisfactory in the writer's hands; first, because the air escapes much more readily through the pylorus, while the carbon dioxide causes a closure of the latter; second, because the air produces no contraction of the stomach, while carbon dioxide does, thus establishing a second factor—the state of gastric tonicity; and last, because, unless the stomach outlines can be readily seen, it really requires an assistant to inflate with the double syringe while the examiner percusses.

Form, Position, and Borders of the Normal Stomach.—In Chapter I, under "The Stomach," this subject has been touched on and some reasons given for the almost endless contours ascertained by different observers, and it is possible, that as with the color of the chameleon, all are right, having each observed the stomach under different conditions. The factors on which the contour of the stomach depends are its elastic walls, which allow more distention in one direction than in another; its autoinnervation, which permits greater contraction in one segment than in another; the shape of the body—i.e., the narrow chest or Stiller type; and the intraabdominal pressure. The form of the stomach differs in the cadaver from that in the living object; it is

different in the various stages of fullness, while in the prone position of the body it is unlike that in the erect attitude. Three general types of stomach are recognized, which are here portrayed (Fig. 15).

Simmonds, from many photographs of the stomach in cadavers, has come to the conclusion that there is no clearly defined normal form, but that many variations of a general form are wholly physiological. With this discussion clinicians have little to do, because by percussion we can map out only the upper portion—or bubble, as it is sometimes called—and the lower, or caudate portion, but not the middle section, which, as viewed on the surface of the body, imparts the appearance of a sack. Still, from comparison with x-ray pictures, one must recognize that this method, though it determines only the lower and right borders, gives us sufficient and accurate information as to

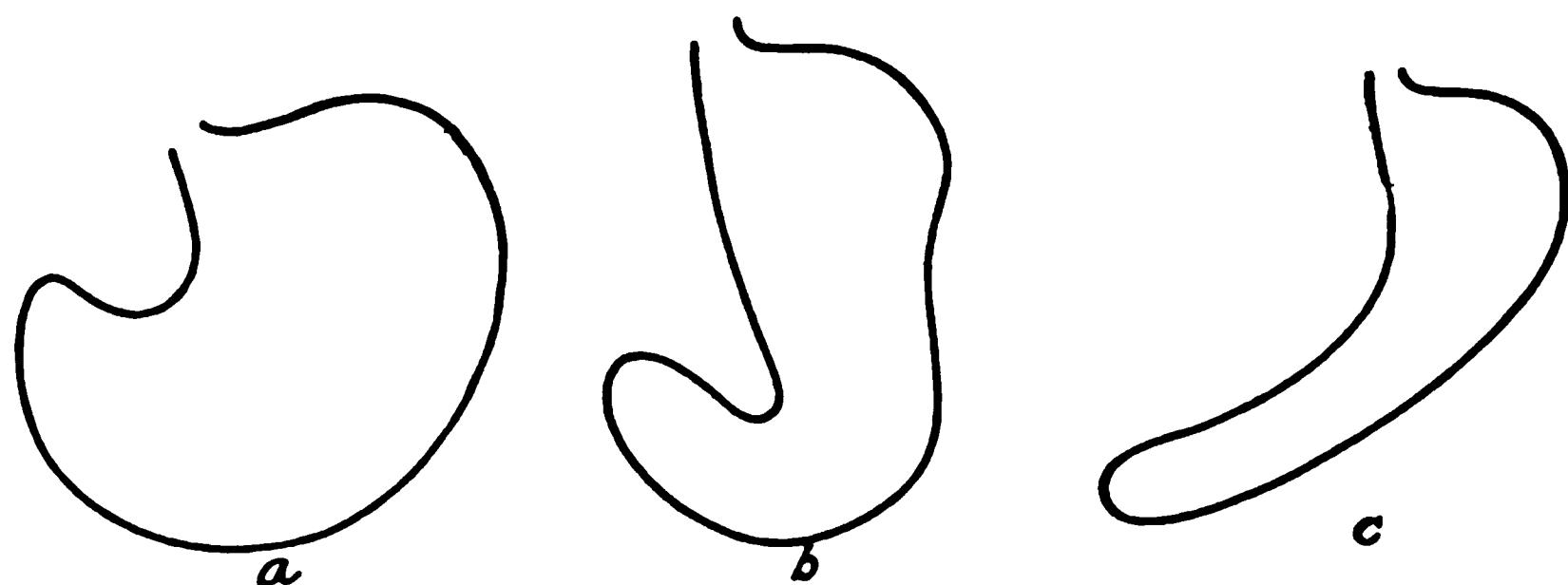


Fig. 15.—Normal form of the stomach. *a*, according to Luschka; *b*, according to Rieder; *c*, according to Holzknecht.

position and size of the stomach, which is all we desire for a clinical interpretation. Hence we must demand a rather wide departure from the limits which have been set as normal before we can pronounce a stomach dilated, unless symptoms of functional impairment are present, for there exists a condition known as megalastria, or congenitally large stomach, which is discovered accidentally and is never associated with impaired motility. The prolapsed or tube-shaped stomach, filling the left flank, however, can hardly be regarded as normal, though no symptoms are present, for on the least impairment of general health we begin to hear complaints of gastric disturbance from those possessing the organ in such a position. All methods of determining the capacity of a stomach by filling it with known quantities of air or fluid are beset with so many errors that but little clinical information can be obtained from them. While, then, firm and fixed lines concerning the borders of the normal stom-

ach cannot be established, yet, with moderate distention and with the patient on his back, the following approximate borders should be regarded as normal: the upper border at the left parasternal line is under the fifth rib, or in the fifth intercostal space; in the left mammary line, under the fifth rib or sixth intercostal space; in the left anterior axillary line, under the edge of the seventh or the eighth rib. The left gastric border cannot be accurately determined, while the right border in its lower part is 5 cm. from the median line, and often inflation of the stomach may extend it to 6 cm. from the same line, through 8 cm. cannot be regarded as abnormal. In the writer's estimation the most characteristic feature is the extension of the stomach tympany on the right side above the costal border, which has been found usually to mean a dilated antrum, and, if constant, may mean adhesions, by which this part of the organ is not allowed to recede as the food leaves it. This conclusion has also been verified by the x-ray picture. Occasionally one comes upon an atonic ileum, according to Mayr, whose distended coils may simulate strongly the dilated antrum by obscuring the lower liver dullness, and from its juxtaposition to the antrum makes the dividing line difficult of determination. That author claims, however, that the tympany changes from the ordinary high tone to a lessened tone when we percuss across the boundary between the two organs. The gastric border subject to the greatest variation is the lower. The reason for such indefiniteness is that the lower border is dependent on age, sex, previous pregnancies, general build of the body, and state of nutrition. It is generally conceded that this border is most often in the lower third of a line drawn from the xiphoid process to the navel; in women it lies a little lower than in men. The action of age manifests itself by bringing the lower border in children less than 15 years of age down to the navel, a point to which it often returns again at the age of 50. Between these two ages no influence of this character can be detected, and previous pregnancies always lower this border. Muscularly developed and well-nourished men usually have this border at the junction of the middle and lower third of this line, and rarely in the upper part of the lower third; this point is at a distance of from 3-5 cm. from the navel in this line. Men lacking a physical development and poorly nourished have the lower border in the lower third to the navel. Well-nourished women have the lower border in the lower third and poorly nourished at the navel; hence we cannot speak of pathological changes unless in the prone position, on the back, the lower border is found at the navel or below it.

Pathological Changes in the Gastric Borders.—An ascent of the upper border may be due to excessive filling of the stomach with gas, to retraction of the left lung, or to elevation of the organ *in toto*—caused by abdominal meteorism, ascites, or a tumor. A lowering of the upper border may be due to kyphosis, as in one case reported by the author, emphysema (common), and an accumulation of fluid in the left pleural cavity, all of which are accompanied by a lowering of the diaphragm. Naturally, a prolapse of the stomach will always be accompanied by a lowering of the upper border. The right border may sometimes be pushed to the left by tumors of the right kidney, or, as R. Schmidt reports, by a tumor of the hepatic flexure of the colon. Tumors of the liver, however, are apt to push the stomach to the rear; much more often the right border of the stomach is pushed still farther to the right—even to a distance of 9 cm. from the median line, due to dilatation of the antrum pylori, whereby there is always present a certain degree of atony and impairment of the advance of the digested food toward the duodenum. Hence this advance of the right border of the stomach still farther to the right is looked on by many as clinical evidence of gastric insufficiency. According to Schuetz, the extension of the right border of the stomach often accompanies lack of motility, but is not an invariable concomitant. The elevation of the lower border may be due, of course, to the same causes, which produce the same condition of the upper border—viz., ascites, meteorism, and tumors of the abdominal walls. Much oftener, however, and of much more diagnostic importance, is the lowering of the lower border (below the navel with patient on his back), which may be due to prolapse of the organ as a whole, or to enlargement or displacement of the stomach in a vertical direction (so-called tubular stomach). Hence, from the determination of the lower border alone we cannot distinguish the position of the stomach or whether it is enlarged, and to this we must always add the establishment of the other borders for any clinical interpretation. Every diminution of the volume of the thoracic cavity—whether it is a low-lying diaphragm, a narrowing of the thorax (particularly the lower portion), relaxation of the abdominal walls, or insufficient filling of the intestines on which the stomach rests—will cause a prolapse of the stomach. Thus we see that many agencies may act in depressing the lower border of the stomach. There may be an enlargement of all the dimensions of the organ, known as ecstasy or megalogastria, or a fall of the organ *in toto*; in the latter case, there is, of course, a lowering of both the upper and lower borders, which is generally known as true gastrophtosis.

Then, again, we may have the upper border fixed at its normal height, but the lower depressed, or a partial gastrophtosis, with a stretching of the stomach in its long diameter. This peculiar condition is probably only simulated by the dropping of the pyloric portion, while the cardia remains fixed, for on inflation one can often see the organ lying diagonally across the abdomen, with the pyloric portion pointing toward the right iliac region. The most varied changes in position and form of the stomach can be produced by tumors, adhesions, and retractions dependent on scar tissue. The most marked of these clinically is the hourglass stomach caused by the contraction following the healing of a gastric ulcer, which divides the organ into two separate chambers, with a narrow opening between, often admitting only the forefinger. Many methods have been devised for detection of this condition. Sometimes it may become visible by inflation if the abdominal wall be thin, but the newer method of x-ray photography after the bismuth meal has proved most satisfactory. The percussion-auscultation method, which consists in placing the stethoscope over that portion of the abdomen where tympany is most marked, and then proceeding outward in radial lines by light percussion or by friction on the skin, marking with a pencil the point where the note changes, has been employed to mark gastric boundaries. Unfortunately, however, the distance of the point percussed from the stethoscope bell makes a marked difference in the note, whether one is beyond the underlying stomach or not, so that the method is not to be relied on.

Percussion of that portion of the abdomen where the intestines are supposed to lie rarely gives any definite information as to their site or condition. Both empty portions of the intestine and those filled with feces, especially those parts at the sides of the abdomen, may give zones of dullness, which, if relied on, lead to error. With intestinal meteorism present, those distended coils afford a metallic tone, but this is obliterated when the abdominal walls are strongly contracted. If this metallic tone remains constant at a certain point, it indicates a stenosis of the gut beyond, but it is not absolute. Nothnagel has called attention to the fact that, if the narrowing is in the descending colon, this peculiar note is better elicited over the loin of that side than in front; with stenosis at the splenic flexure, this can be obtained over the right loin. The disappearance of the hepatic dullness is usually interpreted as meaning accumulation of gas in the peritoneum, but, if the collection of gas in the intestine is great enough, the liver can be so made to assume the horizontal that there is scarcely any liver

dullness left. Tumors of the intestine may cause a localized dullness, provided that the distended gut does not overlie them.

AUSCULTATION OF THE GASTROINTESTINAL TRACT.

Especially in the digesting stomach, but also to a less degree during fasting, certain spontaneous sounds can be heard with the stethoscope over that organ, produced by setting in motion air and fluid through its peristaltic action. These may be regarded as pathological when they can be heard without an instrument—in fact at a considerable distance from the individual. They often have a bubbling, spurting, splashing character, sometimes with a metallic tone. They usually mean increased peristalsis, and, as they are more often heard in women, may be due to narrow corsets or sometimes even to pure nervousness. They are much more marked with increased gas content of the stomach, which may be produced by hasty eating and drinking, by which more air enters the organ; or by fermentation, by which gas is evolved. In many cases the observation has been made that these noises occur only during inspiration and expiration, or, if the breath is held, they disappear. In one instance a girl who had suffered for years from dyspeptic symptoms, and in whom the noises could be heard at a distance of several feet, there was evidently an hourglass stomach present, and the sound was produced by the air rushing through the narrow opening on respiration. In another case the x-ray picture showed an enlarged gastric bubble at the upper portion and a marked depression of the surface of the bismuth suspension with every inspiration. Here there was a dilated stomach, with marked swallowing of air, and the rush of air into the bismuth mixture caused the sounds; in fact, the aerophagy is usually to be regarded as the cause. Among the spontaneous noises of the stomach is to be reckoned the so-called belching or gaseous eructations, to which reference has been made in the chapter on semiology (Chapter III), a paroxysmal succession of loud explosive sounds, which are caused by excess of contained gas due to fermentation or air which has been voluntarily or involuntarily swallowed; or, as is sometimes supposed, where there is an insufficient closure of the pylorus, the entrance of gas from the intestine into the stomach takes place. Most often it manifests itself in the imperceptible act on the part of nervous or hysterical patients of swallowing air—true aerophagy. In those habituated to this custom, which has its analogy in the "cribbing" of the horse, the air enters the esophagus only, without reaching

the stomach, and we have swallowing and noisy ejections alternately—the same volume of air being swallowed and discharged. In other cases the air swallowed enters the stomach until the intragastric pressure forces it out with a noise like air released from a compressor; again, it may be sucked into the stomach with inspiration where the cardia is relaxed. Often there is in dyspeptics a sense of fullness which they think they can overcome by efforts ~~at~~ ^{of} eructation, unaware that with each effort they swallow as much air as they eject, or possibly, by increasing the intragastric pressure, are able to remove the gas which previously did not have tension enough to cause the stomach to contract. It is noticeable that patients often declare ~~that~~ ^{that} a glass of soda water—charged, as we know, with gas—will often, when drunk, afford relief. That in many cases this act is purely voluntary is proven by the energy with which the act is practiced by patients in a clinic who wish to impress the physician with the severity of their suffering. Not all, however, who practice this act are to be regarded as neurotics, for often a careful examination will discover a gastric disorder whose relief checks the eructation; the other class will usually cease when their attention is called to the futility of it as a means of relief. Among these sounds there is one group which has a real diagnostic importance, known as the deglutition sounds. If we place a stethoscope over the epigastrium or over the tenth or twelfth thoracic vertebra behind, and the patient be asked to swallow a mouthful of water, two sounds are heard, the first immediately after the act itself and the second a few seconds later. According to Meltzer, the first is caused by the forcing of the fluid into the esophagus by the contraction of the pharyngeal muscles and the second by the liquid, accumulating above the closed cardia, being forced gradually through this opening into the stomach. When the esophagus is narrowed by a stricture, the second sound is very much delayed, or may not be heard at all. Unfortunately, as this sound may fail to occur in perfectly normal individuals, its value as a diagnostic point is somewhat impaired. Since we have had the x-ray the importance of this sign has been lessened, though recently, in the writer's experience, the second sound was lacking in an individual in whom the radiogram showed no stricture, but at the exploratory operation the surgeon reported a large malignant mass high up in the lesser curvature which involved the cardia. At least we may say that, if the second sound is heard distinctly and without delay, there can be no narrowing at the cardia. Schuetz warns us against listening for this second sound while the patient is lying down, for in this case a

series of splashing, broken sounds are heard, which are dependent on the fact that the fluid does not drop directly to the cardia, but flows gradually along the posterior wall of the esophagus. There are often heard over the pylorus at the end of a contraction phase, or in the interval between, particularly if much fluid has been taken, various



Fig. 16.—Stomach with malignant disease of the cardia. (From collection of Dr. Atrial W. George.)

spurting, gurgling sounds which are not to be regarded as indicative of a pathological condition, but in the writer's experience are much more noticeable when the exit of the stomach has dropped, bringing it nearer the abdominal wall. They follow each other at regular intervals, and are valuable only in determining the position of the

pylorus, as is the point in the chest, where the first cardiac sound is loudest, for marking the probable site of the heart's apex. These sounds are also useful at times, on account of their regularity, in differentiating a contracted palpable pylorus from a section of the intestine which may be felt. Auscultation, too, may be employed in determining the lower border of the stomach, after the effervescent mixture is taken, by listening at different points in a downward direction until the hissing sounds made by the bubbles are no longer heard, which point marks the lower border of that organ. It has been recommended that only a gram each of tartaric acid and sodium bicarbonate, dissolved separately in 25 c.c. of water, be taken, so that the evolution of gas will be less violent, that the patient remain in an erect position, and that we listen with the ear against the abdominal wall instead of with a stethoscope. The point at which the hissing sound is most distinct is to be regarded as the lower border of the stomach, since the fluid gravitates to that point. One great advantage of this method is that we may learn the position of the stomach when the patient is in the erect posture, which of necessity must be much lower than when he is prone. One can easily combine this method with that of Fuld for determining the presence of acid in the stomach by giving the bicarbonate solution alone; then, if no effervescence is heard (absence of acid), the tartaric mixture may be taken.

SUCCUSSION SOUNDS.

When air and a fairly large amount of fluid are present in the stomach, we may produce sounds by sharp, short, downward blows on the abdomen over the stomach with the tips of the curved fingers, comparable to the noise produced by shaking air and water in a bottle, the so-called slopping or succussion sounds. Sometimes patients can also produce them by quick, forcible inspiration, or often complain that the sounds are heard when walking or rocking in a chair. Oser was probably the first to make use of these sounds for the detection of the lower gastric border. In order to accomplish this, one must proceed systematically, with short pushes with the tips of the bent fingers to the left of the median line, vertically downward, as long as sounds can be produced, the last of which will mark the lower border; then, beginning at the left at the point where the sounds were loudest, proceed to the patient's right, choosing the period of expiration for the blow, and, when no more sounds can be produced, we have reached approximately the right border. These sounds can be elicited, where

the walls are not too thick, in perfectly normal stomachs, and they have no significance except the aid they afford to the determination of the position and size of the organ. The succussion sounds can be regarded as pathological only when they can be elicited over the organ at a time when the normal stomach is supposed to have passed its contents along into the intestine—that is, twelve hours after the evening test meal consisting of soup, meat, potato, bread, and butter, or three hours after the test breakfast of bread and water, as will be more fully described under test meals. When, after these intervals, succussion can be distinctly obtained, it means that the fluid is still present in the stomach, and indicates either a retention of the contents or a hypersecretion of gastric juice. Perhaps it is well to distinguish between splashing produced by deep and fairly forcible blows on the abdomen—which, as stated above, can have no value except when the interval after the last meal and its character is taken into account—and superficial succussion obtained often by the lightest touch on the abdominal wall. The latter has been interpreted as meaning a relaxation of the gastric walls, which prevents the organ from closing firmly around its contents. An objection to this, however, is presented because superficial splashing is favored by the thinness of the abdominal walls and prolapse of the stomach, by which a larger part of the organ lies in contact with said wall, thus introducing two other factors. Some would attempt to make these conditions—thinned abdominal walls, gastrophtosis, and gastric atony—always allied, and no doubt the former two do encourage the advent of the last at a later stage, but all of us must have found many times thinned belly walls, prolapsed stomach, and loud superficial splashing without the slightest evidence of atony as demonstrated by gastric insufficiency. Furthermore, it has been the author's experience that by treatment the insufficiency due to atony may be overcome, but the splashing and gastrophtosis continue. Hence it can be seen that these splashing sounds do not necessarily mean gastric atony, for their intensity depends on the greater amount of gastric surface in contact with the abdominal wall; in fact, with pyloric stenosis where the stomach is prolapsed and enlarged, though compensatory hypertrophy of its walls has taken place, and there can be no question of atony, loud splashing sounds can be produced. The true value of these sounds rests in their indicating that fluid is still present in the stomach, and by their location they indicate the lower and right borders, and in this way also indicating the size and position of the organ. We cannot leave this subject without saying something about

the systolic epigastric murmurs in growths of the stomach. These are heard best in the epigastrium, and R. Schmidt has found that they are more distinct on expiration. Outside of the aortic aneurisms and Lænnec's hepatic cirrhosis, these murmurs are always significant of gastric cancer, and they are especially valuable when palpatory findings are not distinct. In expiration, epigastric depth is least and the aorta is brought nearer the abdominal walls, which probably explains this respiratory peculiarity. They are undoubtedly due to compression of the aorta by the growth, since they are more readily distinguishable when the stethoscope is pressed down more firmly.

As far as the intestines are concerned, auscultation offers us but little assistance. It is claimed that, in perfectly normal individuals, at from four to seven and a half hours after food is taken, rhythmical sounds can be heard over the cecum due to the passage of the contents through the ileocecal valve. Then, too, we have the tormina intestinorum in nervous individuals, which are loud gurgling sounds, often heard at some distance from the patient, and have the same significance as those heard over the stomach. Similar sounds, but appearing periodically, can be heard in intestinal stenosis, which sometimes lead the sufferer to recognize his own malady. As they are conveyed some distance from the site of the narrowing, they have only a limited value in localizing its position. Over a distended coil of the intestine, which affords a metallic tone by percussion, one can sometimes hear metalliclike rustling sounds, or they can be produced by blows upon that portion of the gut with the finger tips. Friction sounds like the rub of leather, exactly similar to the pleuritic friction sounds, may be heard with the stethoscope when there is a dry inflammation of the serous covering, but it may be as often felt as heard, as already stated. By the introduction of air into the colon, which can be readily done by passing in a soft rectal tube and forcing air through this with a double syringe bulb, we may see or percuss the whole length of this portion of the intestine, marking out particularly the transverse part. This, too, will often aid us in detecting and locating a colon stenosis, provided it is narrow enough. If, however, it is large enough to allow air to pass freely, but not enough to permit the passage of feces, the method may readily lead us into error. If the stenosis is very narrow, the introduction of air causes pain, the air escapes around the tube in the anus, and a stethoscope placed over the lower colon will disclose a long-drawn-out sighing tone as the air passes slowly through the narrowing. When intestinal tumors are present, inflation also aids us by bringing the growth

nearer the palpating finger, provided it is on the anterior periphery of the gut; when, on the contrary, it is situated at the mesenteric attachment, the mass is forced away from the surface, tympanitic resonance appears above, and exactly the same conditions prevail as when a renal tumor lies behind the intestine. The use of the gastrodia-phane, which has an electric light bulb at the end of a gastric sound, by which the contour of the stomach was shown on the abdominal wall in a dark room when the light was turned on, now possesses only a historical interest, since x-ray photography has been employed for delineation of the stomach. The use of the gastroscope, based on instruments of a like nature, by which a direct view of portions of the internal surface of the stomach could be obtained, has, on account of the danger associated with its use been largely rejected.

RADIOLOGICAL EXAMINATION OF THE TRACT.

This examination is to be employed as an adjuvant to our other means of examination. When we first found we could watch the action of the stomach by giving a contrast meal—consisting of 40–60 grams of bismuth subcarbonate, suspended in buttermilk, or other convenient menstruum, which would not allow rapid deposition, and with the use of the fluoroscopic screen could observe every motion of the organ, or at any moment, by means of a radiograph, fix the form and position of the stomach or intestine on a plate—it opened up a wide field for increasing our knowledge of the pathological conditions of that organ. As with all other new methods, the medical profession expected too much of it, hoping that at last we had a means of diagnosis which was infallible, and patients in whose cases not the slightest efforts were made to reach a conclusion as to the nature of the illness, other than ascertaining the history, were sent to the radiologist for diagnosis. Under these unnatural demands, x-ray examinations were pronounced worthless by some who had been disappointed in their exaggerated expectations. At last this method of examination has reached its level as a correlated part of the different means of investigation, in which the amnesia and physical and chemical examinations are included; in fact, it seems to us that, where the results of the other means are not clear or are contradictory, no physician has done his duty by his patient without securing some good radiograms of the digestive tract.

The Normal Stomach.—The normal stomach, to which reference has already been made, has so little fixity of shape that but scanty

importance can be attached to inference from its form. To its contour, however, much significance can be ascribed. Fasting, the stomach forms a sheathlike body, whose edges are folded and on the fold building is based the transverse shortening of the organ; at its summit, even when empty, a considerable bubble of air can always be found, which is distinguished by its peculiar brightness, as compared with surrounding organs as well as with the remainder of the viscera. The form of this is usually a half-moon, with the concavity upward; its size is considerable, and even in the fasting stomach it increases as food is taken and again diminishes, sometimes disappearing as the contents pass through the pylorus. In atonic stomachs this bubble impresses one by its size and persistence, and it is unusually large in the aerophagists. The disappearance of these folds, as the stomach fills, has a marked diagnostic importance, and is completed when the zigzag outlines of the organ assume a smooth contour, which may be accomplished in the normal individual by very small quantities—for instance, 30 c.c. have been found sufficient to cause the obliteration of the gastric folds, the reason for which being the tonicity of the musculature, which induces the organ to close down firmly on its contents. This is called the peristole, and on its degree we may base our opinion as to the tonicity of the stomach; when this is markedly impaired, we find on taking the meal that the long axis of the organ is increased, that the upper level of the content does not extend as high as customary, and that an additional ingestion of food does not change this upper limit. The increase in volume is usually in a transverse direction. In hypersecretion this unfolding of the stomach takes place much more rapidly, while in achylia it is delayed. Whenever, too, the stomach suffers a change of form from the scar tissue of ulcer or malignant disease, again the disappearance of the folds departs far from the normal, and these changes should be observed carefully, since valuable conclusions may be drawn as to the existence of these two diseases.

The contractions of the stomach are not visible in its upper part, but about the beginning of the middle third commence as shallow waves, which grow deeper and deeper until at the pyloric portion the antrum is apparently cut off completely from the rest of the stomach. Both the rapidity and depth of these contractions may vary, and, while little of clinical value may be drawn from the former fact, variations of the latter have been found fairly constant with certain diseases. For instance, the contractions are much deeper when there is a functional or organic stenosis at the pylorus from

the muscular hypertrophy, which may be followed in a longer or shorter time by shallow waves, which are interpreted as evidence of muscle exhaustion. A series of vigorous contractions means a normal tonus of the organ, while shallow waves indicate ectasia or atony. Still, it is not safe to put too much dependence on the degree of the contractions on account of the marked influence of the emotions on the peristalsis; this is equally true of inference as to the musculature based on the same evidence, but the contractions may be so violent that the lower stomach is frequently segmented by them, and yet there may be no organic disease.

In health the pylorus always appears as a clear line between the dark bulbous duodenum (sometimes called the "bishop's cap") and the antrum, both filled with bismuth, but marked changes in this picture occur where the sphincter is involved in cicatricial tissue from ulcer or cancer, or is fixed by adhesions.

The determination of the motility of the stomach is one of the greatest aids we have derived from radiology, but, to be of value, the conditions must not be made too hard and fast. When, with a stomach fasting, one gives 50 grams of bismuth subcarbonate and 350 c.c. of buttermilk, apart from a very small remnant which may remain in the stomach for hours, the organ should be emptied in six hours. When at this period one-half of the original meal remains, we may conclude that there is functional or organic stenosis of the pylorus. Very often, too, one can draw certain conclusions from the picture presented by the residue. If long transversely and half-moon shape, it suggests a decompensated gastric hypertrophy due to stenosis; a moderate residue, lying to the left of the median line, with the greater curvature arising almost perpendicularly, means an ulcer of the lesser curvature, while a similar remnant, with a zigzag right edge, causes a marked suspicion of cancer of the pylorus. Between the x-ray residue and microscopic retention, as determined by washing out the fasting stomach, a parallel usually exists, but occasionally it is found that the bismuth meal leaves the stomach promptly, while remnants can be washed out after the usual eight-hour interval. Huerter's explanation of this is that spasm induced by hyperacid contents is a partial cause for this retention, which is, of course, relieved by the bismuth's power of neutralization. Again, the x-ray may show moderate retention, while washing brings to light no fragments; this, according to Dodds, depends on the inability to direct a soft tube to the most dependent part of the stomach, so that the water introduced does not disturb the small pool of residue and comes

back clear. In this respect, then, the new method cannot replace the old and both should be employed, and operation, too, can determine which is to have the most successes to its credit.

By no other means have we been able to determine the size and position of the stomach with exactness as we have by röntgenology. The lower border of the stomach in the radiogram should, if normal, be at the level of the navel, and, while the latter point in the obese and in others is a variable one, all efforts to replace it have failed. In a radiogram where the navel has not been marked, the body of the fourth lumbar vertebra should be selected as the point with which the normal lower border should correspond. A true ptosis of the stomach, in its acquired or congenital form, comprises a lengthening of the longitudinal axis, with lowering of the pylorus and displacement to the left. It lies as a long tube, with parallel sides to the left of the vertebrae, while the lower border is found far below the iliac crest. While the picture of the acquired gastrophtosis, due to rapid emaciation or childbearing, is much the same in many respects, there is this difference, that, due to accompanying atony in the latter, the bismuth meal fills it to about one-half of its capacity, and above this the air bubble forms an inverted wedge. The lower portion of the stomach is enlarged, while, in accordance with its extent, the pylorus assumes a position lower down and to the left of its normal site, and is freely movable. Another characteristic feature of the ptosed and atonic stomach in the radiogram is the narrowing found at its center, which is not spastic and should never be taken for an organic constriction. While the time of emptying may be normal, it is usually somewhat prolonged, and, if dilatation is added to misplacement and atony, it is distinctly prolonged. Extensive dilatation from stenosis can be distinguished in a radiographic examination from the enormous distance between the bubble and the bismuth, which assumes naturally the lowest section of the stomach, while, owing to a lack of peristole, the lateral contours of the stomach are not well defined. An absolute proof of dilatation due to organic stenosis is the finding of any considerable residue in the stomach twenty-four hours after the meal. Beginning decompensation differs from this picture in that the contractions begin much above the middle third, as is usual, and produce deeper waves, which may lead to gross segmentation of the organ; then the waves become shallower, and, unless the compensation of the stenosis is nearly at par, there will occur a complete cessation of peristalsis for a time. Therefore the violent contractions alone, on account of psychic influence, can-

not be interpreted absolutely as a sign of stenosis, but those followed by quiescence can be so regarded. Radiology has also shown us that gastric spasm may exist, accompanied by pain, without any local cause for it. These spasms, though confined to the lower two-thirds of the stomach, may produce the most unusual shapes—semblance of the hourglass stomach, temporary obliteration of the pyloric portion, or such a picture as is seen in an interstitial contraction (*linitis plastica*) of the whole organ. In addition to the above more general and extensive spasm, we may have a tetanic contraction of a certain group of circular muscles, which produces a radiogram precisely similar to that of true hourglass stomach, which is often called the “pseudo” form. Not alone this spasm, but tumors of adjacent organs—like the spleen, kidney, liver, and pancreas, or retroperitoneal glands when enlarged—may so press on the stomach as to give this impression of a division into two parts. Naturally, from a therapeutic standpoint, it is very essential to distinguish the spasmodic variety from the true, produced by contraction of scar tissue from an old ulcer. The most valuable answer to this question is whether this division is permanent or variable, though a spasmodic contraction may remain pretty constant, even when due to an ulcer at the side, which does not produce a narrowing by scar tissue. Then, too, in the spasmodic form the lower section is promptly filled by the contrast meal, which is not true with the organic form.

Gastric Ulcers.—Gastric ulcers, unless they have produced narrowings, are very difficult to detect by the x-ray examination, and the newer method has helped us but little in diagnosis. Whether situated on the anterior or posterior surface of the stomach, the bismuth meal obscures them fully. Ulcers in the pylorus are no easier to detect because the spasm of the long muscles prevents the depression from filling. When much scar tissue, however, has formed and the edges are firm and rigid, there is a distinct difference. After the bismuth meal is taken, these appear as projections on the surface or contour of the picture if situated on the anterior wall; on the posterior and in the pylorus but little hope is offered for their detection, but this diverticulum projection of the stomach usually disappears as the latter empties, and in only the rarest cases does it persist. The opening or crater of such an ulcer is always filled with bismuth, and only in penetrating ulcers is a bubble in its upper section visible. When such an ulcer produces adherence to a neighboring organ—the liver or pancreas—then the gastric juice digests away a portion of it, making a considerable cavity, which contains bismuth and an air bubble

above, connected with the stomach by a narrow canal, discernible because it also contains contrast material. These penetrating ulcers are also to be distinguished from cancer because they always add to the contour of the stomach and never take away any portion, as the latter does. On account of the narrow communication, this may fail to be portrayed by the picture, and then we have a failure of the cavity to empty when the stomach does, so that it looks like an excrescence on the finely discernible contour. By means of the irritation of the nerve endings, which are laid bare by the ulcer, we may have spasm of circular or longitudinal muscles, with corresponding distortions in the figure of the stomach. The former gives us the appearance of the spasmodic hourglass stomach, whether fresh or chronic, in which the nerve terminals are inclosed in the scar tissue. As stated, purely psychic influences may produce these deep segmentations of the stomach, so that, if they are to be of any value for the diagnosis of ulcer, they must be constant and always at the same point in the subsequent pictures. When the longitudinal muscles are incited by an ulcer, then there is a rolling up of the pyloric portion, compared to the appearance of a snail; by this spasm the pyloric portion and the pylorus itself are found to the left of the median line. Sometimes the spasm becomes so great that the ascending portion of the stomach and the pylorus appear so adherent that the dividing line between cannot be ascertained. These conditions are typical, but not at all constant, so that, by radiology, peptic ulcer—unless at the pylorus and accompanied by stenosis—is one of the most difficult lesions to discover. It is much different, however, with gastric cancer, and, as the ophthalmologist may often diagnose a probable nephritis before other clinical means of examination show it, so the radiologist may often detect a cancer when only vague symptoms and no marked loss of gastric functions are present.

Cancer of the Stomach.—This has the peculiarity of growing into the lumen of the organ, leaving in its radiogram a defect in the contour, which may vary as to site, form, and extent, corresponding with the growth. Furthermore, the defective periphery may be zig-zag or have a moth-eaten appearance, characteristics which so differentiate such outlines from the clear-cut contour of the normal stomach that diagnosis of cancer from the radiogram presents, perhaps, as little difficulty as any when visible. Then, again, the scirrhouss form—the most common—produces marked distortion in the shape of the stomach, usually in the direction of distinct diminution in its size, and at the same time marked insufficiency of the pylorus is pres-

ent. Two other characteristics of this condition, either under the screen or in the picture, are the loss of peristalsis and, where the pylorus does not functionate, a backing up of the food in the esophagus, which has led in one case under my observation to a radiological diagnosis of cancer of the esophagus, while the introduction of the tube and the palpation of the mass showed the tumor to be at the



Fig. 17.—Gastric cancer. (From collection of Dr. Ainsel W. George.)

pylorus. Ordinarily, the growths situated at the pylorus can be most easily portrayed. When, however, they are located on the anterior or posterior wall, the contrast meal may obscure them, unless pressure is made on the stomach, when the regular outline is brought out. In a normal stomach the pressure of the finger tip produces only a rounded clear spot on the periphery. The new growths at the cardiac portion of the stomach are very difficult to detect with the x-ray

because the contrast meal does not fill this part with the patient in the erect position. Still, there are often changes in the contour of the air bubble, in the middle of which the growth is usually situated, which indicate its presence; these changes are exaggerated by distending the stomach with air and by examining the patient in a prone position. In a matter as important as this the question will often arise, is röntgenology infallible? Confession must be made that other causes may produce these defects in the filling of the stomach which are interpreted as cancer, such as (to mention a few) retroperitoneal masses of enlarged glands when the growth is in an adjacent organ; cancer of the choledochus, primary or secondary; a pancreatic growth, which compresses the pylorus without its involvement—as in a case of my own; a mass of inflammatory tissue from a cholelithiasis may give the appearance of a prepyloric cancer, perigastric adhesions, and, rarely, varices, which have produced pictures mistaken for those of gastric cancer. Another vast advantage of the radiogram is that it will enable us to find tumors in locations absolutely forbidden to palpation, as in portions of the fundus where the ribs interfere or under the liver. It is true, they often descend when advanced, so that they are palpable, but that is an event occurring often too late to enable us to offer any aid to the patient. Two questions we should be pleased to have radiology answer for us, but so far it has failed: is a pyloric tumor benign or malignant and are there metastases? In regard to the former point, some aid is offered by the size of the stomach, which often becomes enormous from the dilatation of an ulcer stenosis, but rarely enlarged to any great extent from primary cancer; it may be already dilated when cancer follows ulcer. The radiogram has been of greatest aid to us in demonstrating just what happens after gastroenterostomy. This question comes up frequently when symptoms occur after such an operation: has the pylorus become patent and the new orifice closed, or does there exist a "vicious circle," as it is called, by reflux of food through the new opening and has its departure by the pylorus taken place? Now, a good functioning gastric fistula can always be recognized in a radiogram as a projection from its lower border, which is in reality the first filled section of the intestine; this projection can depart in its full width from the stomach or show a constriction just as it nears the stomach wall, and is usually found to the extreme left. After the bismuth is taken, one must wait some time before the segment of intestine is visible, showing that the stomach can be filled as well as the normal one. Apparently, too, the food escapes at intervals exactly as it does

through the pylorus, though no valve action can be present. All explanations of a fold of intestine producing valve action are based only on theory; of the other numerous explanations offered for this procedure, none have any clinical value and may be omitted. An interesting fact, however, is that, when no food can be seen to pass through the artificial orifice, but all goes through the reopened pylorus, laparotomy, for some other purpose, has shown that the gastroenterostomic fistula is fully open. In our experience it has occurred that a new growth has closed the artificial opening, and ulceration around the pylorus has freed it from obstruction. It has been further established that, when marked ectasia of the stomach from stenosis exists, gastroenterostomy relieves the stasis, but does not improve the gastric tonus. When the pylorus is removed or artificially closed, the emptying of the stomach is not markedly changed from that accompanying the simple gastroenterostomy, and, even when the anastomosis is not made at the most dependent portion of the stomach, the latter is equally as well able to free itself from the food which lies below the level of the orifice.

The Intestine.—The intestine is made visible by means of the x-ray examination, either after ingestion of the contrast (bismuth containing) meal, or, for the lower stretches, an enema of the same substance may be used with better results. To begin with its first portion (the duodenum), we may say that only the bulbous portion—or bishop's cap, as it is termed—is distinctly visible; from this point on—as a result of the periodic discharges from the stomach and the marked dilution produced by the fluid entering the intestine—apart from the faintest shadows, which are readily overlooked, no accumulation of bismuth again occurs that enables the tract to be distinctly seen until we reach the lowest part of the ileum. In between, occasional small segments are visible, but, on account of the many lines and levels, it is impossible to construct, even in the mind's eye, the ramifications of the continuous intestine.

For the portrayal of the colon a period of twenty hours after the bismuth is taken by mouth, or directly after an enema, is chosen, when, in the latter case, the lower ileum may be found filled, but in the former the descending colon and sigmoid may be discerned empty, and a later period must be selected, dependent on the motility. In the radiogram of the colon the most suggestive feature is the segmentation or haustra, which may be so deep that they suggest complete separation of the fecal portions. This appearance is most marked after ingestion and less so after an enema, but even then they are

distinctly present in constipation, accompanied by spasm. The cecum shows but little of this segmentation, and is not well separated in the picture from the ascending colon, but the entrance into it of the

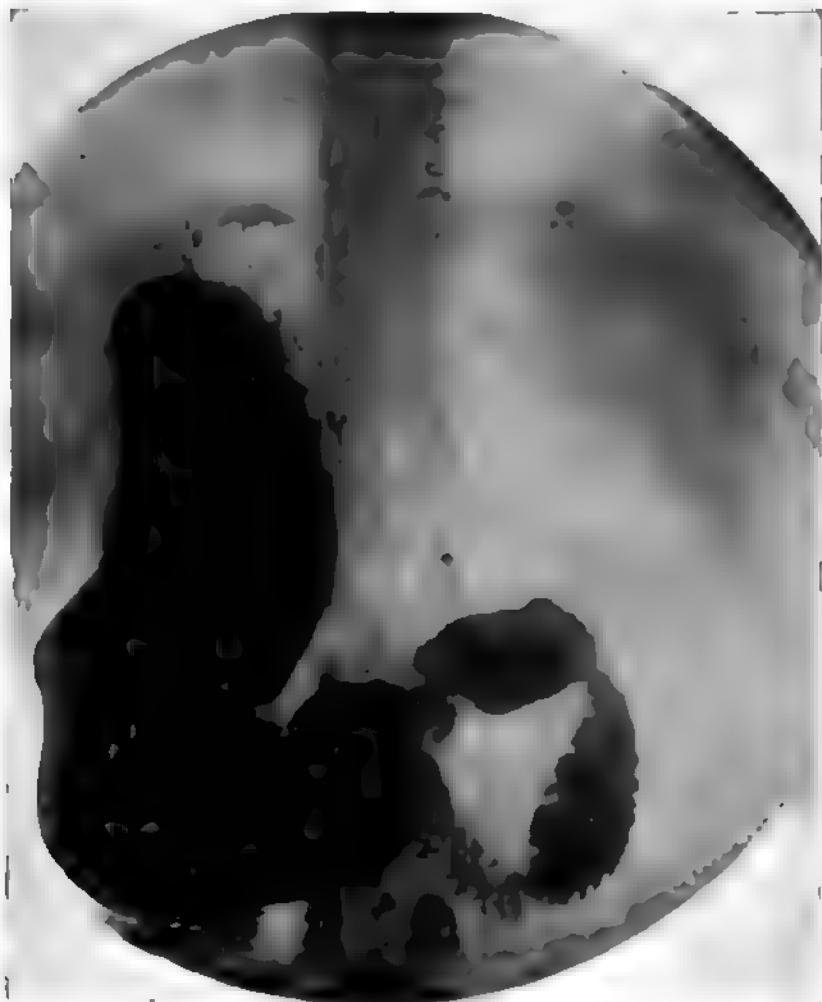


Fig. 18.—Normal bulbous duodenum (bismuth esp). (From collection of Dr. Aris W. George.)

ileum is usually well marked. The appendix is often visible, whether bismuth is taken by the mouth or rectum, and remains filled, for days sometimes, after the rest of the tract is free from the contrast material. Radiology is, of course, our best means of studying the

motility of the intestine, yet no fast and fixed rules have been established with which to compare abnormal results. Not every unusual delay at the ileocecal valve—ileal stasis, so termed—means bands or membranes, nor does a forty-eight-hour detention of bismuth in the colon denote a marked loss of tone. The determination of position by this means has been particularly valuable in the detection of congenital misplacements, especially in the redundant sigmoid, causing great accumulations of feces or Hirshsprung's disease. Particularly valuable is the radiogram in detecting the marked congenital looping and displacement of the hepatic flexure of the colon, and, together with the screen and palpation, in excluding adhesions of two adjacent portions whose shadows so overlap that they appear as one. As a means, too, of explaining many obscure forms of functional constipation, radiology has played an important part, and has enabled us to determine whether the delay is in the cecum and ascending colon, due, as Faulhaber believes, to an early solidification of the fecal matter; or in the descending colon, due to spasm, which is particularly prominent in the sigmoid; or in the rectum, either from weakness of the defecating muscles or unusual drying out of the fecal matter.

Ulcerations of the intestines have also shown the value of radiology in their detection, but such successes are rare and not to be expected. The successful radiograms of duodenal ulcer show the projections with the combined bismuth and air content, but many an ulceration of this character exists where no characteristic feature can be obtained. Indirectly, however, in the rapid emptying of the stomach we have a proof of the greatest importance. Furthermore, the ulcer scar may cause spasm of the first portion of the duodenum, readily visible when some distance from the pylorus, but, as over 60 per cent of such ulcers are within a centimeter from this point, it is rarely available for diagnosis. When the pylorus is held firmly to the right of the median line and does not recede on emptying of the stomach, we have proof of adhesions, which may be equally as well the result of duodenal ulcer or cholecystitis. The ulceration of the cecum, so common in tuberculosis and malignant diseases without stricture, furnishes a characteristic picture of the intestine, which shows this part and the greater portion of the ascending colon obliterated. This may be explained by the superficial ulceration, causing such an exaggerated peristalsis that no considerable amount of bismuth can remain there, and operation has confirmed so many of these findings that there can be no doubt of its accuracy.

The stenoses of the intestine, whether due to circular contraction from malignant disease or from scar tissue following ulcer, or to external compression from incarceration or compression by bands, are readily detected by the x-ray. Again, one must be warned against accepting mere constriction as proof of this, and demand must be made for a radiogram showing a considerable stretch of intestine beyond the narrowing, either empty or very scantily filled. The detection of stenosis of the small intestine, other than the lower ileum, is very difficult because of the normal lack of continuity of the bismuth column, but in the colon, when the contrast material is given by enema—when, of course, the obliterated portion lies in the opposite direction with reference to the narrowing—such pictures are very satisfactory, indicating closely the site, and at operation prevent undue handling of the intestine. When a constriction is chronic, it is much more advisable to combine the two methods of oral and rectal administration. Furthermore, one should always demand that the intestine be emptied by preliminary laxative or by cleansing enema, and that the stricture be constant in a subsequent examination after a few days. It has been shown also that it does not require a very marked narrowing to prevent the advance of the bismuth enema. Again, after a relatively short delay it is sometimes found that, where the passage is not too narrow, the bismuth may continue its course, filling the portion beyond not as fully as that before, but the margin is so small that much judgment must be employed to properly interpret the findings. A repeated examination is much better where, in case of true stenosis, the same features are found.

When cancer of the colon is present with stenosis, the ingestion of the bismuth does not offer as good an opportunity for a characteristic radiogram as does the enema. If the growth is in the transverse or descending colon, or there is failure of the dilatation before the stricture, as occurs where the feces are liquid, though there is delay at the constriction, the feces reform beyond. There will naturally be at this point an hiatus in the continuous shadow of the colon, but little dependence can be placed on this alone, for it has been known to occur in a perfectly normal intestine. When, however, the stenosis is fairly narrow, and there is found an enormous dilatation before it, represented in the picture, there is barely a ribbonlike trace beyond it, the bismuth is retained for days, the feces are fluid, and, because of the difficulty which gas finds in making its way through a stenosis with liquid feces, the upper portion of the colon will be found free from the contrast material, similar to the air bubble of the stomach.

The dividing line between these two will always be found horizontal. The appearance of cancer of the cecum with stricture does not differ from that of tuberculous ulceration, mentioned above, twenty-four hours after ingestion. The whole middle abdomen is filled with detached fragments of bismuth shadow, many with the air bubble above

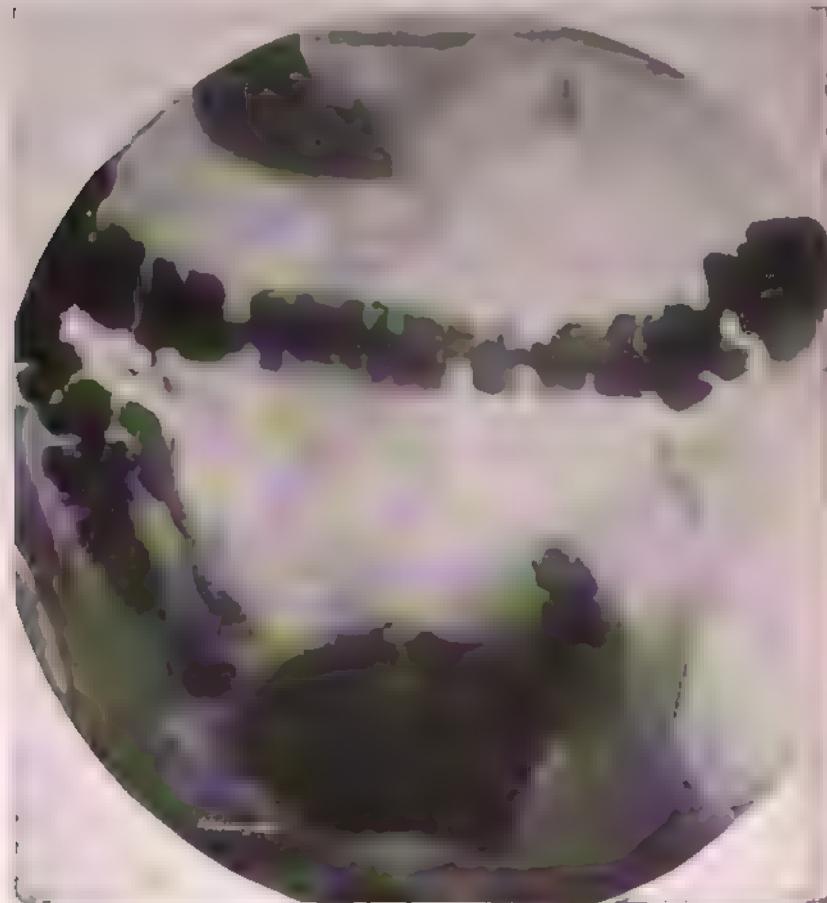


Fig. 19. Carcinoma of the cecum with stenosis. (From collector of Dr. Atrial W. George.)

and with a horizontal line of demarcation. The cecum and colon are blotted out of the picture when the contrast is given by mouth, and a similar appearance is found in stricture of the small intestine, only, of course, when the bismuth is taken by the mouth.

The contrast material has been known to remain in the intestine as long as seventy-nine hours. These gas bubbles, with their contrast

material base, are found at the turns of the small intestine, varying in size, and are most characteristic, because, no matter how great the accumulation of gas in the intestine may be, they never form except when there is stenosis. When in chronic stenosis of the small in-



Fig. 20.—Cancer of the rectum, bismuth ingested. (From collection of Dr. Arul W. George.)

testine much intermittent rigidity occurs above, this picture is largely modified, for both gas bubbles and horizontal surface may disappear during the contraction. Diagnosis between the large and small intestine is usually not difficult, because in the former the degree of dilatation is much greater than could probably be found in the latter;

still, in the latter the haustra persist, though markedly less distinct. Then, again, in the colon only one or possibly two levels (dividing line between gas and contrast material) will be found, while in the small intestine, on account of its ramifications, many such levels are

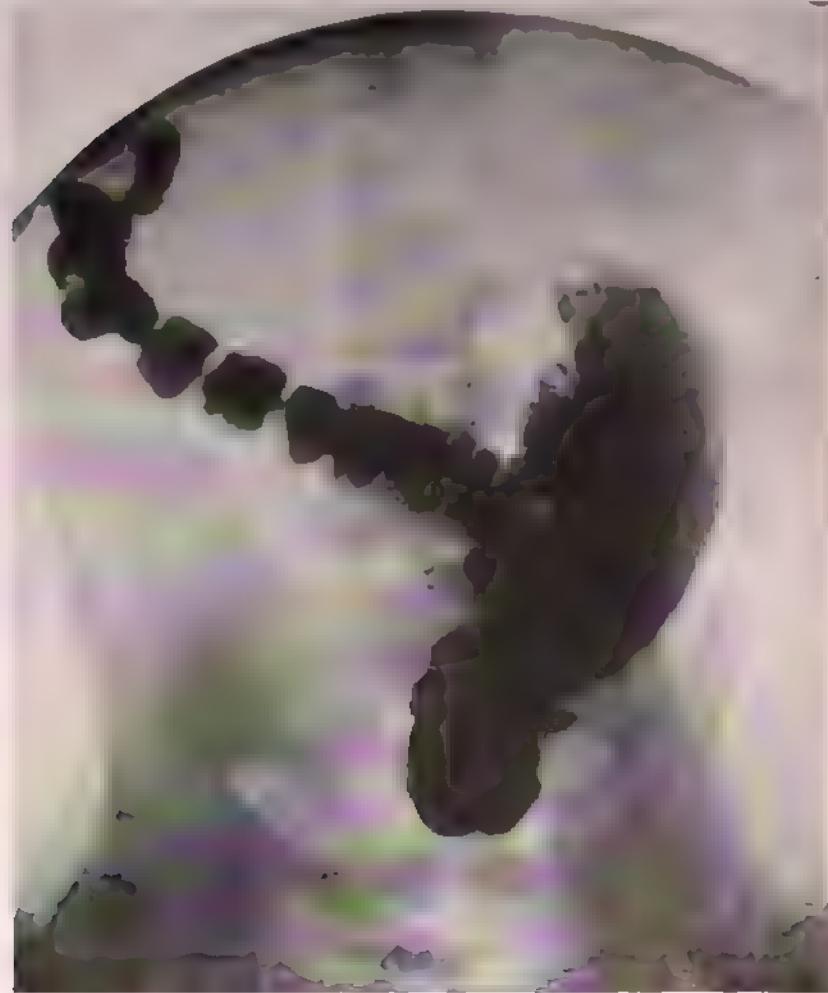


Fig. 21. Adhesions of parts of the colon. (From collection of Dr. A. W. George.)

present. When the ileocecal valve is forced by the stagnating contents from a colon stricture, then this deduction would be worthless, but in any case of doubt a contrast enema would settle the question.

A stenosis of the duodenum at considerable distance from the

pylorus gives a very characteristic appearance of distended intestine, contrast material, and air bubble, because, as stated, outside of the bulbous portion, the duodenum is not discernible by the x-ray under normal circumstances. Under the screen, too, can be watched the violent peristaltic waves which drive the intestinal contents to a certain point, but cannot force them beyond it. As already stated, a radiogram can inform us that a stricture exists, but can tell us nothing as to its character, whether malignant or not, as it can in the stomach. Furthermore, radiology can offer us no aid in the diagnosis of cancer of the intestine where no stricture is present. The radiogram is equally of aid in determining the presence of rectal cancer when it cannot be reached by the finger and a rectoscope is not available, and equally as advantageous in determining its extent when that instrument can not be introduced on account of the narrowness of the opening.

Adhesions and unusual mobility of certain sections of the intestine can often be made out by the x-ray, except in the first portion of the duodenum, which escapes on account of its protected position under the liver. These adhesions are most readily detected in the colon, which under the palpating hand behind the screen, if normal, can be moved about freely in all directions, particularly the transverse portion. If the colon is apparently attached to an internal body, like the liver, or to the abdominal wall, an attempt to move it will be found impossible; if attached to a movable body, like the stomach, or to another section of itself, an attempt to place the hand vertically on the abdomen and to press down, so that it shall separate the shadows of the two organs or parts of the same organ, it will succeed, except where an adhesion is present. Then, too, the radiogram is most useful in showing displacements of the colon due to abscesses and tumors. Such transpositions are often the result of hydro-nephrotic tumors, which press the ascending and descending colons toward the median line, as do psoas and iliac abscesses.

RESULTS OF THE X-RAY EXAMINATIONS.

Perhaps, in closing, a short critical résumé of the practical or clinical results of the x-ray examinations of the tract will not be out of place. Some of the most hopeful expectations expressed in previous sentences have met with disappointment, while others have become firmly grounded by our subsequent experience.

Esophagus.—Probably in no field of examination have these means

proved more valuable than in the diseases of the esophagus, particularly in carcinoma of that organ. In 96 per cent of all cases we can, however, usually determine such diseases by the use of the stomach tube and by the history. On the contrary, there are those cases where, when the tube meets with no obstruction, though carcinoma exists, we can learn of its presence only by means of the röntgenograph through a more or less persistence or stagnation of the bismuth in the esophagus. Even the smallest remnants are significant of an obstruction in this canal, and this latter, together with other symptoms of stenosis, leads to a suspicion of carcinoma.

In still greater degree can this delay in the passage of the bismuth into the stomach be utilized for carcinoma of the cardia. Here the doubtful cases are much more numerous than where the growth is situated in the esophagus, since in the latter cases, difficulty in deglutition and inability to pass the tube are lacking. One can often observe, under the screen, a delay in the passage of the bismuth, while the under portion of the esophagus forms a sausage- or funnel-like image. Furthermore, since in such cases, when the organic stenosis is at the cardia, the esophagus shows a more extensive amount of atony, the latter often appears, in its entirety, somewhat enlarged. Still, oftener the detection of the benign disease of the esophagus, especially spasm, comes from the röntgenographic examination. Very often we find patients who complain of a sensation of constriction of the esophagus, with pressure following. A soft sound passes readily, and the delayed passage of the bismuth can be detected only under the screen, and sometimes by means of the röntgenograph. The screen forms the more valuable means of examination under these circumstances, because often the spasm can be seen to relax and the bismuth passes readily into the stomach.

More often do we find, as a result of chronic cardiospasm, the evidences of a dilatation or a diverticulum of the esophagus. Such pouches, as is well known, will sometimes contain as much as three-fourths of a liter of fluid. Under the x-ray examination they appear, in all their outline and entirety, and with such accuracy as cannot be determined by any other means of diagnosis.

Stomach.—*Ulcer of the stomach* has not proved amenable to detection by x-ray examination, except when perforation or marked obstruction have been produced.

Two features of the ulcer, however, have been fairly well established in the röntgenographic examination—first, the spastic contraction of the greater curvature, and, second, the delayed emptying of

the stomach. The former, however, unfortunately is not always constant, and it must be repeatedly found at exactly the same point to make it reliable. In several cases which have been operated under my advice, nothing was discovered by the röntgenologist, while the surgeon readily detected scar tissue at the lesser curvature, indicating an old ulcer. Then, as previously mentioned, we must also recognize that such contractions may arise from purely nervous influences. Then, too, this contraction can have another clinical value, such as pointing to an ulcer of the lesser curvature, but does not in any way indicate an ulcer at the pylorus. As to the second point—delay of the stomach's emptying itself—such a condition may be produced by or be due to pyloric spasm associated with hypersecretion, without organic disease. No one questions, however, that, when an ulcer is situated at the pylorus, it may and does produce a marked delay in motility, and therefore we can restrict this method of diagnosis to ulcers which are situated at the lesser curvature and at the pylorus.

When, however, callous ulcer exists, and thereby produces marked contraction of portions of the stomach, it is readily seen in the röntgenograph, and probably can be discovered in no other way, when not situated at the pylorus. Furthermore, this form of ulcer often produces a small diverticulum, which shows in the picture as a projection from the stomach contour, and which often remains, the bismuth appearing as a shadow, long after the other portions of the stomach are freed from their bismuth content. This, when appearing, as it usually does, at the lesser curvature, becomes the more significant, since ordinarily this outline is entirely free from constriction and appears in a uniform line with the rest of its periphery. The frequency of this symptom, even when callous ulcer exists, is probably overestimated, since, whenever situated on the posterior or anterior wall of the stomach, it becomes no longer visible. This, again, is demonstrated by the fact that there are patients who often present a perfectly normal gastric picture, and, when operated, on account of the persistence of their symptoms, are found to have this form of ulcer.

The second and most important form of the callous ulcer is indicated by the perfect hourglass stomach on the plate. When this appears, and the constriction in the middle of the stomach is constant, without question a chronic ulcer is present, situated at this point, producing the narrowing of the organ.

Unfortunately, the röntgenograph cannot tell us whether the hourglass stomach is dependent on a contraction of an old ulcer, on peri-

gastritis, or on a functional tetanic muscular contraction produced by the influence of the ulcer. On the contrary, the supposition that the distinction can be made by the rapid filling of the lower portion of the stomach, which always counts in favor of the spasmodic contraction, has not been substantiated by further experience. The so-called "snail" form of the stomach, or curling up of the lesser curvature, so that the pylorus and the cardia approach each other, has also lost its practical significance and is now rarely mentioned. The determination as to whether a callous ulcer has penetrated a neighboring organ is usually supposed to be demonstrated by the presence of an air bubble over a diverticulum, but it is not constant and has lost its significance.

When, after the departure of the bismuth from the stomach, a portion remains upon its periphery, it is significant, of course, of a penetrating ulcer, but it is not at all constant. There is no question, however, that diagnosis of the hourglass stomach was never firmly grounded until we were able to use the x-ray examination. Usually this appears upon the plate as a constriction, indicating a contraction, due to scar tissue arising from ulcer.

Pyloric stenosis is unquestionably readily detected by means of the röntgenograph, but the same condition can also be detected by our former means of diagnosis—namely, the tube—so that the x-ray examination is often superfluous. Furthermore, the extent of narrowing can frequently be as well determined by the amount of residue which is obtained from the fasting stomach as by means of the amount of bismuth retained at the end of the same period. On the contrary, the sound cannot distinguish between an organic and a functional stenosis, as can be done by means of the x-ray. In addition, a sound will and can give us light as to the amount of residue which can be obtained from the fasting stomach and also that a portion of the stenosis is due to spasm, thus indicating an ulcer in the vicinity of the pylorus, which has caused a permanent narrowing, facts which the radiograph cannot impart.

Duodenal ulcer is claimed by many röntgenologists to exhibit a clearly defined and distinctive picture upon the plate; others rely on various activities of the stomach under the screen, such as increased peristalsis, opened pylorus, and rapid departure of the bismuth into the duodenum. None of these latter symptoms have been proven to be constant in the presence of a duodenal ulcer, and, in all probability, diagnosis by these means can be made only when sufficient distortion has occurred to prevent the filling of the so-called "bishop's

cap." When the duodenal ulcer is situated some distance from the pylorus, a condition which rarely occurs, and stenosis has been produced, the broader shadow of the duodenal portion above the stenosis, together with the increased peristalsis of that portion, give us satisfactory evidence of an ulcer. Such conditions are extremely rare, and eminently satisfactory for means of diagnosis only when they occur. On the whole, it seems safer to rely on the symptoms—gastric analysis and the presence of blood in the stools—than to base our diagnosis on the appearance of a duodenal ulcer upon the plate.

Gastric cancer forms the most satisfactory object, apart from the hourglass stomach, for the exhibition of the accuracy of the x-ray diagnosis. The characteristic appearances are filling defects in the outline of the stomach wall, marked diminution of its volume, and missing peristalsis. When, however, the growth is situated at the pylorus, probably producing only a stenosis of that organ, together with a dilatation of the stomach, we cannot from this alone determine whether we are dealing with a malignant or a benign process at this point. Frequently, after exhausting all our clinical means of diagnosis and failing to reach a definite conclusion as to whether malignant disease exists, the radiograph will clear up the matter at once. On the contrary, early diagnosis of carcinoma, an aim to which all clinicians are aspiring, is seemingly not aided in any way by the use of the x-ray. Furthermore, another important question as to whether malignant growths of the stomach are operable, which has resisted all previous means of clinical effort, resists equally as well the x-ray investigation. On the whole, while the x-ray examination is a valuable adjuvant to our other means of investigation, so far it does not seem advisable to rely on it alone, or to base our opinion on its findings when they do not correspond with those acquired by our other means of investigation.

Ptosis of the stomach and adhesions about the pylorus, particularly associated with gallstones, which are often portrayed, may be detected by the röntgenograph on account of the fact that the stomach fails to recede to the left when its content leaves it. Furthermore, usually, the stomach is found, particularly its antrum, to be drawn well to the right of the vertebral column.

Intestines.—The results obtained from the radiological examination of the intestinal tract are distinctly disappointing. As to changes of position, the evidence obtained is, of course, distinctive and positive, but, as no one has yet been able to demonstrate what the normal posi-

tion of the intestinal parts are, such portrayals have little distinctive value.

Tubercular and malignant stenosis of the small intestine can be detected only when they reach an extreme stage of narrowing, and can then usually be made out by physical examination in the form of rigidity of the immediate portion of the intestine before the obstruction.

Adhesions are rarely detected except at the ileocecal valve (Lane kink, Jackson membrane, etc.), which are shown by the delay of the bismuth mixture in entering the cecum, and by the increased caliber of the lower section of the ilium. Furthermore, these demonstrations often exist when at operation the surgeon can discover no reason for the delay of the contents.

Appendicitis and cecum mobile may be demonstrated, but the appendix so often fills with the bismuth mixture when no symptoms of inflammation are present that the value of this phenomenon must be largely discounted.

Tubercular and malignant stenoses of the colon are, however, more often detected by the x-ray, either when the bismuth is taken by the mouth or injected by way of the rectum. Still, the radiologist will often hesitate to pronounce an interruption of the continuity of the bismuth shadow the result of organic disease on account of the frequency of functional spasm of the colon. Such has been our experience, when operation showed an annular carcinoma of the descending colon.

With reference to this point, the views of others may not be without interest. Hänisch declares that the x-ray examination of the colon is satisfactory under conditions as here stated. In the first place, the bismuth should not be given by mouth alone, but rectal injections should also be employed. Furthermore, the röntgenograph alone is not sufficient, and the patient should be examined in a prone position before a screen while the bismuth is being injected into the rectum. The following conditions may be established by these means: changes of position, formation of loops, dilatation and stenoses of the canal, adhesions and spasms, as well as the connection of palpable tumors with the intestine. By this means true stenosis of the intestine can usually be distinguished with moderate certainty from pressure of neighboring growths, spasms, and narrowing by means of adhesions. Complete dependence should not, however, be placed alone on this means of investigation, and one should not rely on a single examination, but on two made at considerable time apart.

Only rarely is a positive early diagnosis of carcinoma possible, and in most cases the x-ray examination gives sufficient evidence of a probable stenosis to warrant an exploratory laparotomy.

Jeomans recommends that the x-ray examination should be employed only as confirmatory of the results of previous physical examination. Such a röntgenograph will show abnormalities with reference to size and position of the colon, as well as indicate stenoses, almost as accurately as they can be demonstrated by operation. He claims that, if such radiological examinations are made, operations will become far less numerous.

Rectal carcinoma, if high up, may require an x-ray examination for its diagnosis; or the proctoscope, if the growth can be reached by that instrument, will give us much clear information as to the site and character of the growth.

Coloptosis and megalocolon often demand an x-ray examination, and these conditions, being based on a change in position and size, probably cannot be detected by any readier or more accurate method.

RECTOSCOPIC EXAMINATION.

The *rectoscopic examination* of the lower intestinal tract has all the advantages of radiology in the detection of stenosis, together with the added value of offering us a view of the condition of the mucous membrane, including any ulcers, bleeding points, benign or malignant growths, or bulging due to the pressure of pus from an adjacent abscess. The introduction of the well-oiled instrument may be made in the Sims position, when air must be blown in to keep the intestinal folds away from the field of vision; or the knee-chest position may be chosen, which by gravity and atmospheric pressure straightens the rectum and sigmoid and removes some of the angularities. Hence there are two types of instruments—those following the Strauss model, with an attachment for blowing air into the canal at the inner end of the instrument, and those patterned after Schreiber's rectoscope, which contains no such attachment and relies on the patient's position for facilitating the introduction. Another most important feature is the light, which can be obtained from a small battery or from an electric light, controlled by a good rheostat. This lamp can be placed either at the distal end of the tube, where it is liable at any moment to be obscured by feces or mucus, or at the proximal end, where it is under constant control by the operator, and the light is thrown into the canal by a reflector. The lamp and its reflector take up so little

room that all manipulations may take place through the tube, but the current must be fairly strong (0.7 ampere, 5-7 volts) to illuminate the distant stretches of the sigmoid. Now, while a short instrument—a true rectoscope—is most advantageous for the investigation of the ampulla or for treatment, a long instrument must be introduced if the lesion is not found there and we wish to investigate the region higher up, which necessitates the removal of this one and the introduction of another much longer—a true romanoscope. On account of

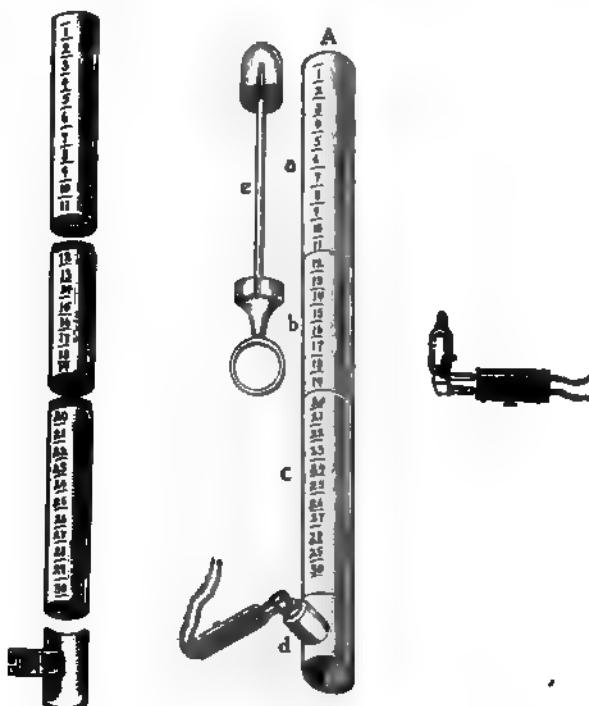


Fig. 22.—Von Aldor's rectoromanoscope. *A*, tube in three parts, *a*, *b* and *c*; *e*, obturator, *d*, attachment for lamp.

these special needs, von Aldor has devised a combination of the two instruments, of which a figure and an explanation are given. (Fig. 22.) This instrument, which is made by the Berlin Medical Warehouse, consists of three tubes (*a*, *b*, *c*) of a length of 10 cm. each, which can be attached to each other by finely threaded screws or by a bayonet attachment; an obturator (*e*), which can be inserted into the first one (*a*) to facilitate introduction, an attachment (*d*) for holding the lamp, and the lamp itself. These tubes are graduated into centi-

meters, and, when united, give a scale of 1-30 cm. The obturator fits only the first section, as it is never needed after the introduction of the first portion, and the distal end of the first section has a round, dull edge. This enables one to proceed from the examination of the rectum to that of the sigmoid by simply uniting one section of the tube after another and slipping on the attachment for holding the lamp, thus doing away with a series of instruments of different lengths and their obturators. The lamp is the ordinary diminutive electric bulb, requiring usually a current of only 0.40 amperage and four volts, which is placed in a pocket or depression in the side of the tube, having a window only in that part directed toward the distal portion of the intestine, while the rest of the receptacle is converted into a reflector. Thus the lamp itself is so protected that it cannot be easily broken or soiled, and takes up so little of the lumen of the tube, since it does not project more than a few millimeters beyond the inner periphery, that manipulations through it are not restricted. The directions for the use of the instrument are very simple. The patient, without any unnecessary preliminary cleansing enema, assumes the knee-chest position, and, after the introduction of the first section with its well-oiled obturator, the latter is withdrawn, the lamp inserted on the sacral surface, and the left hand assumes wholly the direction and further advance of the rectoscope, leaving the right hand free to remove—by means of a long applicator armed with cotton, which may also be oiled to remove any fragments or feces obscuring the vision—any flecks of mucus which may obscure ulcerations. By slowly pushing the instrument forward, waiting a moment, if it meets resistance, for the spasm to subside, or smearing the tissue beyond the tube with tepid oil, it is usually possible to reach the sigmoid without difficulty, and a perfect view may be obtained of ulcerations, polypi, etc., even at that distance from the light.

CHAPTER V

ACQUISITION AND EXAMINATION OF GASTRIC CONTENTS

After so many years' employment of the described method of solving the problems attendant on disorders of digestion, it needs no defense, and the only reason why this method has fallen into disrepute with some practitioners is that by its means alone they expect to make a diagnosis, while one well versed employs the analysis of gastric content as only one of the means of examination, faithfully endeavoring with all means at his disposal to form a composite picture of the disease before him. For obtaining gastric content, nothing better has ever been devised than the Jacques tube of soft rubber, with a closed end and two side openings, whose edges should not be too sharp, or, if they are, should be dulled by passing a red-hot needle over them. The length of this tube should be 75 cm.; its caliber, 8 mm.; and its diameter, 12 mm. Such tubes have been used by the writer for years, but the great disadvantage is that they are made abroad, and, after several unsuccessful efforts to secure an equally good article from American rubber companies, we had better, in the writer's opinion, let the stomach tubes be "made in Germany." All bulbs, funnels, and cups incorporated in the tube are entirely unnecessary, and complicate an otherwise very simple and easily cleaned instrument. It is particularly desirable, in buying such an article, to demand that the tip be made of solid rubber for some distance before the interior of the tube begins, but the latter should extend beyond the second side opening a short distance, so that a probang may be introduced inside the tube to guide it if necessary. For cleaning the tubes, it is only necessary to wash them well externally with soap and water, after which run water through them, which can be readily done by passing the open end inside a faucet outlet, and boil them out if any suspicion of malignant or specific disease in the patient exists. The introduction of the sound is best accomplished with the patient in the sitting posture, with the head bent slightly forward. The writer's experience with the patient lying down has never been satisfactory, as the tube more readily enters the larynx. The individual should be allowed a sip of

water—false teeth, if present, should be removed—and, when the end of the tube is against the pharynx, the patient should be asked to swallow, the physician at the same time passing the instrument rapidly into the stomach after being assured by the absence of air rushing through the tube that it is not in the larynx. Two difficulties are, however, liable to be met—first, inability of the patient to swallow, due to spasm of the pharynx, and, second, an almost cramplike closure of the teeth on the tube, preventing its further introduction.

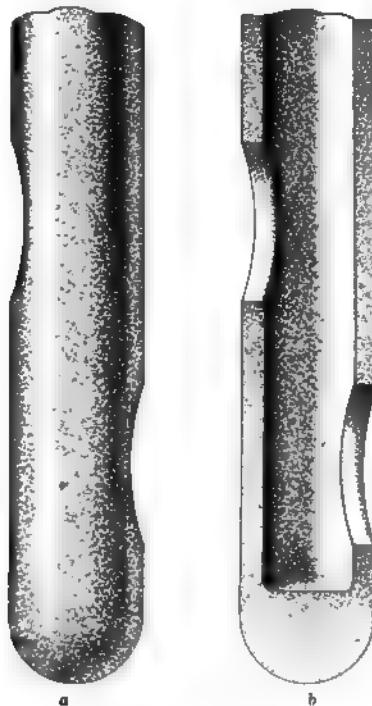


Fig. 28.—Gastric tube. a, lower end of the gastric tube, b, cross section of the tube; enlarged one-half natural size

Both these difficulties can frequently be overcome by asking the individual to hold the receptacle which is to receive the contents. It is amusing sometimes to note the patient's almost cramplike grasp of this vessel, which requires force to remove it from his hands, yet it distracts his attention and lessens the pharyngeal spasm, which seems to be partially voluntary. After the tube has been introduced to a depth of 50 cm. or more, the contents often flow at once; if not, the patient is asked to press as at stool, or, by moving the tube back and

forth, efforts at vomiting are ineited, which force out the contents. After the fluid has ceased to flow, or even if it does not flow freely, the outer end of the tube should be pinched against the side of the vessel with the right hand and the instrument withdrawn with the left, allowing any contents in the tube to run into the glass. Even when fluid does not run out of the tube in this way, sufficient will be

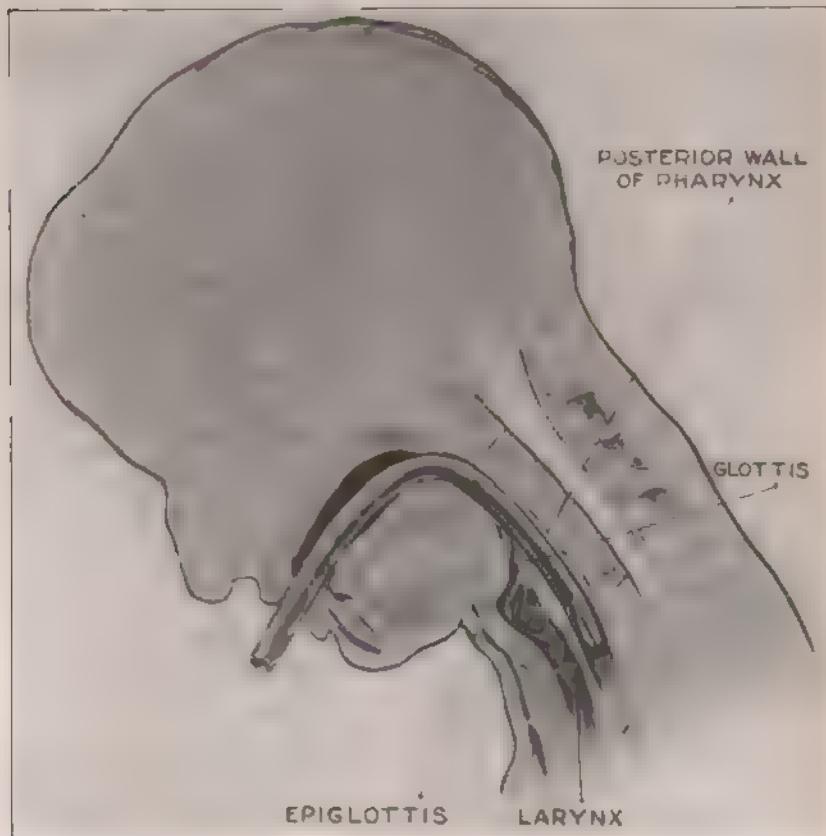


Fig. 24. Sagittal view of the tube in place between larynx and posterior pharyngeal wall.

found in it for the quantitative tests. Another way, if the contents do not flow, is to have a Politzer bulb at hand, which can be compressed, inserted into the outlet of the tube, allowed to expand, and removed, when the flow will often start. As a substitute for the Politzer, an ordinary oval bulb of thick rubber may be used, into the open ends of which two glass unions may be inserted that taper at one end, which may be inserted into the open end of the stomach tube.

If we wish to aspirate, we may compress the bulb after insertion and hold the tip of one finger over the open end, or, by placing the finger tip over the end and then compressing the bulb, we may force air through the tube to dislodge a crumb of bread or any obstacle which may be occluding the tube. This bulb has a great advantage over the Politzer in that it can be more easily cleaned, and by means of the glass tube we can see whether any fluid has been raised from the stomach. Furthermore, by pinching the tube and compressing the bulb we may force into the vessel any gastric content and repeat the process. In some stomach tubes this bulb has been incorporated in the tube itself, but from hundreds of removals of gastric contents the writer's experience is that in so few is aspiration needed that it is better to use the bulb as an accessory rather than as a constituent part of the outfit. Besides the condition mentioned where no fluid flows from the tube—probably on account of an atonic stomach, lax abdominal walls, and, as at times seems assured, corsets in women, and where with withdrawal of the tube with tightly pinched outlet will often secure us as much as 10 c.c. of content—we occasionally come on instances where none of these artifices are of any avail. Some are cases of increased peristalsis with normal pylorus, some of achylia, where, contrary to general opinion, it is not increased motility, but lack of gastric juice, which prevents us, because, pouring in a small amount of water and then lowering the tube, we may cause to flow out practically all the bread of the test breakfast: and some examples of a low lying stomach in which the eyes of the tube cannot reach the level of the fluid. In all such cases it is well to pour in 250 c.c. of water through a small funnel inserted into the tube, which so stimulates the contraction of the stomach that the contents readily flow out on lowering the end of the tube. While such diluted contents are useless for chemical examination, their macroscopic and microscopic appearance may be of great value.

Much has been said about the preparation of the patient and the tube for removal of gastric contents. Some advise cocainizing the pharynx of the patient and chilling the end of the tube, but the writer's experience has been that a swallow of water and as little fuss and as great speed as possible on the part of the physician lead oftenest to the desired end. More suffering is caused the patient, at least mentally, by thinking about the act after the formal announcement on the part of the doctor, or from the old woman's tales of others who have had it done, than by the process itself. In the writer's college days the tales of hazing, which were intentionally exaggerated, caused

more fear than the demonstration itself when it arrived, and this is equally true of the passage of the tube, described as "pumping the stomach" to the victim by others who have had it done and are not above a mild exaggeration. The individual with whom absolutely nothing can be done is one who persists in pulling out the tube, such as one often meets among the ignorant frequenters of a clinic, and with such, after the exhibition of a fair share of patience, the writer refuses to have anything to do. In the writer's experience failures have occurred oftener when others were looking on, such as students in the clinic or overanxious relatives in the office, when patients seem especially excited and subject to spasm, so that the physician should learn as far as possible to work without assistants, or, what is still better, make the patient an assistant in the manner mentioned above. It has already been stated that the tube may be sometimes introduced into the larynx, which is instantly indicated by cough and air whistling through the tube in respiration. This happens both when the head is thrown backward and when the patient fails to cooperate by swallowing, particularly if we attempt to force the tube against the resistance of a pharyngeal spasm, and the tube should, of course, be immediately withdrawn and another effort made. Then, too, we should watch the face of the patient, as it may become dusky—either because he voluntarily holds his breath, like the crying child, or spasm of the vocal cords occurs, so that croupy breathing may be heard, and both are indications for the removal of the tube. While these complications are to be borne in mind, it is astonishing how many hundreds in a large clinic will have the tube passed, often by inexperienced assistants, without a failure. When a patient almost faints at the sight of the tube, is pale and trembling, it is well to appoint another day for the act, when he or she may be more composed. The fear of causing a hemorrhage with the sound, even in chronic ulcer, is exaggerated, for it has occurred only twice in the writer's experience in many hundred cases, and even then the amount of blood coming from the tube was trifling. The patients, one a young Hebrew, a bleeder, and the other a sufferer from chronic gastric ulcer (who had had no spontaneous hemorrhage for a year) were not harmed by the process. It is also remarkable that even cases of gastric neurosis are benefited by the passage of the tube, for by its findings one is enabled to assure the patients that no organic disease exists, a condition which they have been dreading. The indications for the use of the tube are to first clear up the question of esophageal stenosis, for, when it is spasmoidic in character, the soft tube works better

than the stiff probang. Outside of this, of course, the main object of the use of the tube is to obtain the gastric contents, which should be done whenever other means of examination do not show us readily that there exists a pure gastric neurosis or nervous dyspepsia, as it is sometimes called. Even then we have variations in the acidity of the content, varying from entire absence in achylia to an excess—hyperchlorhydria—conditions which produce most of the symptoms, and which we cannot treat intelligently without a definite knowledge of their presence. In the meantime it cannot be too much emphasized that we should not be content with such an examination of gastric contents alone. It can be easily seen that in one instance—that of heartburn, so-called—no intelligent therapy can be employed until by the use of the tube and examination of gastric contents we can determine whether it is due to relaxed cardia, hypersecretion, or fermentative processes. Perhaps the rule of E. Schuetz is as good as any—that in comparatively fresh cases, if no relief from diet and medicinal treatment is obtained in a period of fourteen days, we should proceed at once to the passage of the tube; this will avoid its unnecessary employment, and at the same time prevent us from long continued, unavailing treatment of a supposed functional disorder when a chronic ulcer, achylia, or early gastric cancer may be the originating cause of the digestive symptoms.

CONTRAINDICATIONS.

The contraindications to the use of the tube, apart from the instances mentioned where it is impracticable, are found in all forms of heart disease or damaged arteries, though in well-compensated mitral regurgitation it has been the writer's practice to employ it for many years without any damage so far. If there is the slightest suspicion of cardiac disease in the pallor, rapid breathing, or dusky lips of the patient, the stethoscope should always be used and the condition of the heart learned. Severe anemia and advanced age are also deterrents to the use of the tube. Previous gastric hemorrhage is no hindrance, provided that four weeks have elapsed since the hematemesis. An examination of gastric contents during menstruation should never be made on account of the marked physiological changes in the gastric juice at that time, almost approaching the pathological. This manifests itself as a hypersecretion which in some approaches the continuous secretion type. At the same time the motility of the stomach is distinctly diminished.

EXAMINATION OF GASTRIC CONTENTS.

The examination of gastric contents may be employed on the contents of the food-containing stomach, or on those of the fasting individual (one who from the lapse of time should physiologically be fasting), to learn the character of the residue in retention or hypersecretion—both pathological conditions. As a general rule, we examine the contents of the food-containing stomach, since food forms the best stimulation of the gastric juice, the so-called "digestive stimulation," to investigate the motor and secretive functions of that organ. Two things must be borne in mind—that, for comparison with normal conditions, the food must be of the same character and amount, and the contents must be removed at the same interval after food is taken.

TEST MEALS.

1. The so-called Ewald-Boas test breakfast consists of a slice of white bread (30-35 grams) and a glass and a half of water (400 c.c.), which should be taken fasting and removed one hour after it is eaten. A normal stomach should be empty two hours after this is taken, and the tube may be introduced at this interval to test the motility, but this is not as satisfactory for the purpose as the meal mentioned below. It is needless to say that the bread must be well masticated and the water taken after the bread is eaten.

2. An evening meal, a combination of the Riegel and Boas meals, consisting of meat, potato, bread, and butter, with the customary beverage—a cup of tea, coffee, or cocoa, or a glass of water—to which, for purposes mentioned later, we may add a saucer of cooked rice with raisins, or, better still, some rice pudding with raisins. The stomach is to be emptied approximately twelve hours afterward, or the next morning, and washed out, when the test breakfast can be given and the patient retained an hour for the second expression, as described in the writer's article on "The Significance of the Ratio of Free Hydrochloric Acid to the Total Acidity in Determining Impaired Motility of the Stomach."¹

3. In addition to the above, the author has made extensive use of the so-called "water meal" for determining both the secretory and the motile powers of the stomach. This is based on the investigations of Carlson and others, who showed that water alone had a marked

¹ *Med. Record.* vi. 8. 1912.

influence in stimulating gastric juice. From them we learn that water alone may induce a gastric juice whose acidity is about 100 in less than twenty minutes after stimulation, during which time practically all of the water, amounting to 500 c.c., enters the intestine. In addition, any residue left in the stomach from the evening before, if the water is given fasting, can be detected. As applied to clinical use, in which the author has employed it in many hundreds of cases, the patient is asked to take the evening before examination a meal of meat, potato, bread, and butter, with rice and raisins, and then come to the clinic the next morning fasting. There 250 c.c. of water are given the patient and the contents of the stomach removed twenty minutes later, the extreme limit at which these authors claim that the water given has left the stomach. The average of acid values with this meal is found to be practically 20 for free hydrochloric and 30 for total acidity.

4. For determining the motility of the stomach, chlorophyl, which is not absorbed from either the stomach or intestines, has been used by Boas. The patient is asked, while fasting, to drink 400 c.c. of water to which 20 drops of the coloring substance have been added. After thirty minutes, whatever remains of the water in the stomach is removed by the stomach tube. The amount of coloring matter removed can be approximately estimated by the colorimetric method—that is, comparison with the same amount of coloring matter diluted to meet the intensity of the color of that removed. It has, however, been found by the author that this method can be satisfactorily combined with the above-mentioned water meal, and, whenever any of the coloring matter remains in the fluid removed after twenty minutes, we may consider that there is a degree of deficient motility on the part of the stomach. The presence of bile may sometimes interfere with the quick appreciation of the presence of chlorophyl, but, of course, any of the tests for bile, preferably the nitrous and nitric acid tests, will promptly distinguish between them.

As will be seen, the first meal is to test the secretory function of the stomach, while the second may serve equally well as a measure of motility or oversecretion. Many have been dissatisfied with the test breakfast, claiming that it furnishes too slight a stimulus, and that a stomach which will readily take care of it will fail to dispose of a larger meal, and employ the Riegel meal, which is practically the evening meal mentioned above, but is to be removed three to four hours after it is taken. The latter has been unsatisfactory in the writer's practice, because fragments of undigested meat frequently

occlude the tube, and often a large mass of fat collects on top of the contents when placed in a glass, smearing all utensils used in the examination. Another disadvantage of the Riegel meal is that the time of removal is not accurately determined, that free hydrochloric acid is less liable to appear—even when the simple breakfast indicates its presence—and that the so-called "layer formation" in the stomach is more pronounced and interferes much more with a composite picture of the secretory function. Hence the writer's practice is to confine himself to the test breakfast and the evening meal, which so far have fulfilled all his requirements. Strauss and others have recommended the use, with the evening meal, of currants, raisins, and prunes, because they leave the stomach less readily than do other foods, and by their color and form are much more readily detected in the stomach washings. It came to the writer's attention accidentally that the shells of lima beans were often found in the fasting-stomach washings, and he has therefore had them added to the evening meal with success. The stomach of the "morning after" should be free from any residue, and the presence of any remnants, however small—"minimal retention"—shows lacking motility, pyloric stenosis, or scar tissue from an old ulcer not at the pylorus, as shown by two cases of the writer at operation. On the contrary, absence of food remnants does not preclude a lesser degree of impaired motility. The writer's practice is always to allow the washings from the fasting stomach to remain in a large conical glass for a time, then the supernatant fluid is poured off and the residue centrifuged; to the second residue a few drops of Lugol's solution are added, which causes the fragments of starch (rice), which also leave the stomach last, to be stained deeply blue, when they can be seen with the naked eye, or very readily with the microscope. Attention is called to careful mastication, for great crumbs of bread—such as are seen after the test breakfast, or, where there is marked gastric insufficiency, in the washings of the fasting stomach after the evening meal—have very little significance when the teeth are poor or the eating is rapid.

The superficial advantages of the water meal are readily recognized. Bread is not always available in the clinic for the test breakfast, but water, of course, is. We can never rely on the time if patients are allowed to take their bread at home and then come to the clinic, while, if taken after arrival, a wait of forty-five to sixty minutes is too long in a busy forenoon. Water, too, as remarked by the before-mentioned authors, allows one to see readily whether there is any residue left from the Riegel meal. This method also avoids a second in-

troduction of the tube, which is necessary if we first attempt to find food remnants in the fasting stomach and then give the ordinary test breakfast. Lactic acid, blood, and bile are also much more readily detected in the absence of a mass of partially digested food. A more complete description of this method is given by the author in an article recently published.¹

The advantage of the chlorophyl method of determination of motility consists chiefly in the fact that no pyloric reflexes are incited and that the remaining fluid is easily withdrawn. No layers are formed by this means and finally, under the pathological conditions, the motility can be determined in a very short time. By estimating the percentage of chlorophyl which has left the stomach during this period, one can easily obtain a standard for the greater or less motile power of the stomach, and can say that this method far surpasses the Riegel method in accuracy and readiness of employment.

From my experience in the clinic, carried out on many hundreds of patients, it has been learned that when a proportional amount of chlorophyl (10 drops) is added to the water meal of 250 c.c., normal stomachs usually pass it on to the intestine during the twenty-minute period, and that the presence of any amount of chlorophyl is fully as significant as the determination of the absolute amount retained, as secured by the Boas method. Of course, we can say only that the stomach has either normal motility or moderately impaired motility instead of the absolute amount of impairment.

By giving the Riegel meal the evening before, when no food remnants are found, we may say that there is no serious impairment in the sense of a stenosis; by detection of the presence of chlorophyl we may say that the motility is moderately diminished, and conclude that it is probably due to gastroparesis or to a condition termed gastric myasthenia.

Three factors enter into the investigation of the gastric contents—the macroscopic and microscopic appearance and the chemical examination.

MACROSCOPIC EXAMINATION.

The macroscopic examination includes, first, the amount and appearance of the gastric contents. The amount is dependent on the motility, whose increase, of course, diminishes the volume and vice versa, while with normal motility an exaggerated secretion increases it. If one were always sure of removing all the contents, these rela-

¹ *Boston Med. and Surg. Journ.*, lxii, No. 28, 1915, 857-859.

tions would be evident, but, as a portion is always solid and does not flow as readily, we never know how much remains. An effort has been made to overcome this difficulty by pouring into the stomach a measured quantity of water (200-250 c.c.) by means of a funnel, and then, by raising and lowering the water, to produce a thorough mixture of what remains with the water in an attempt to form a homogeneous solution. Some prefer to use a larger amount of wash water and wash out the stomach twice with a liter each time, but, whatever amount is used, that returning from the organ must be measured. Then, to determine the total gastric content, we have only to obtain the acidity of the original or first, content with phenolphthalein and that of the residue and the wash water, which we may call No. 2; multiply this volume by its acidity and divide by the acidity of the original amount; to obtain the contents remaining in the stomach. For example, suppose—to use the illustration of J. Schuetz, who recommends the method—the original gastric content amounted to 80 c.c., with an acidity of 50 (50 c.c. N-10 sodium hydroxide to neutralize 100 c.c. gastric content), and the wash water amounted to 2,000 c.c., with an acidity of 10. We have then $\frac{2,000 \times 10}{50} = 400$ remaining in the stomach, which, added to the 80 c.c. undiluted, makes a total gastric content of 480 c.c. The great objection to any of these methods is that we are unable to obtain a homogeneous mixture, for the solid portions carry a large amount of acid united firmly with them, and, on account of sedimentation, it is difficult to distribute these so as to obtain an average acidity for the whole. Then, again, an increase of the residual content in the stomach does not allow one to exclude a hypersecretion. Hence we are never able to say with accuracy how much content there may be at any interval because we do not know how much is left nor, on account of the wide variations in the time of emptying of a perfectly normal stomach, can we say with definiteness how much average gastric content is normal or increased at any period after the food is taken. Yet, by collecting the results of many examinations, one may say that an excess of 120 c.c. of undiluted gastric contents withdrawn one hour after the test breakfast must be considered pathological, without furnishing any information as to whether there is a lacking motility or increased secretion. To overcome this lack, the writer's practice has been to adopt the suggestion of Zweig, as explained in a previous article of the author,¹ and centrifuge the same amount, 15 c.c., of the well-mixed contents

¹ *Boston Med. and Surg. Jour.*, 1911, 77-80.

for three minutes in two graduated tubes, of which the average solid portion in the tubes is to be compared to the total volume. If one-fifth to one-third is solid—that is, fills the tube to less than the 5 c.c. mark—we have a hypersecretion; if beyond the $7\frac{1}{2}$ c.c. mark, there is a lack of tonicity of the stomach. Strauss employs sedimentation by gravity only, and Elsner determines the solids of the stomach washing, both methods requiring much time, but they all have their weaknesses. First, it is natural that the portion left behind has much more solid than liquid constituents, so that their relation in that removed is not a fair criterion; then, again, the better masticated and digested the bread is, the less thick the layer it will form, so that the digestive factor enters also. Furthermore, where there is much mucus, it is almost impossible to drive it to the bottom of the tube, and it often has attached to it many bread fragments, while, even if it is driven down with the solid portion, it increases the thickness of the layer without having anything to do with either secretion or motility. Boas has attempted to detect the presence of hypersecretion by giving a dry meal and removing its contents an hour later, when, as he says, if the secretion is normal, there will be but a few cubic centimeters of content, but Kemp has demonstrated, by giving the same patient the dry meal and the Ewald, that there is practically little difference, either in the amount withdrawn or in the relative thickness of the layer formed by the solid portion. Besides this condition of increased secretion due to exaggerated stimulus of the food, we have a variety, probably of the same condition, where the secretion continues after the food has left the organ, sometimes called a continuous secretion. That brings us to the question of how much gastric juice there should be in a fasting stomach. This has been variously stated at 10-50 c.c. Probably the latter is nearer the average, and if with this increased amount of fasting gastric juice we have stomach symptoms, and after the test breakfast an increased amount withdrawn, we may conclude that we have a hypersecretion before us. It is beginning to be more and more recognized that this hypersecretion, be it alimentary or continuous, has a chronic gastric or duodenal ulcer, or the scar following such, as its basis; and, while we cannot as yet go as far as Mayo and say that a nervous hypersecretion never exists, still the more careful our search the more often will we find some organic change in the wall of the stomach as the source of this secretory excitability. The condition known as periodic hypersecretion, accompanied by migraine, epigastric pain, and vomiting, is probably only an exaggeration of the disease described.

and, if the patient is examined during the intervals, it has been the writer's experience that a moderate increase in the secretion of the gastric juice will be found under the slight stimulus of the bread and water. Much care must be taken to distinguish between fasting residue and secretion, which cannot always be done at a glance. The latter must present the following characteristics: it must be of the color of water or tinged lightly green, transparent, opalescent or cloudy from a few flakes of mucus, like the washing of the mouth; hydrochloric acid is always present in amounts from 15 to 60 and the addition of a few drops of Lugol's solution should produce no change of color other than the yellow of the iodine. No gas bubbles should be present, and the sediment should consist of epithelial cells and leucocyte nuclei, and only *rarely* a starch granule. *Sarcinæ* and yeast spores *in chains* must be wanting, and the solid as compared with the fluid portion must be less than one-twentieth. The residue resulting from stasis will have some or all of the opposite characteristics, particularly lessened or absent hydrochloric acid, *sarcinæ* in great numbers, and many starch remnants. The solid portion of the gastric content may be "well digested"—that is, so finely divided that it looks like a powder at the bottom of the glass—or "poorly digested," when great bread crumbs are seen, much as when bread is chewed and spit out, which latter condition is often found in achylia. An inspection of the state of the solid portion can best be made after the content has stood some time in a conical glass, or by pouring some of the content into a plate, when also the mucus can be more readily examined. From a coarse, slightly comminuted sediment we can draw only the conclusion that gastric digestion is faulty when mastication has been thorough, for inefficiency in that act produces the same general appearance. When there is a large amount of hydrochloric acid present, the bread is usually in a fine powder, unless there is considerable mucus, which seems to protect the gluten from the action of the gastric juice, when we may have the appearance of a poorly digested solid residue. The "three-layer" arrangement of a content, after standing for some time in a glass, is very suggestive of atony or stasis, and is made up as follows: at the bottom is a layer of solid material, then above this a layer of cloudy fluid, with no food particles, and at the top a layer containing many gas bubbles and made up chiefly of mucus and some food particles. The *odor* of the content also gives us some information as to the conditions in the stomach. An alcoholic odor, like fermenting wine or cider, indicates an active fermentative process from yeast; an unpleasant odor, like

that of rancid butter, means the presence of organic acids; and a putrefactive odor, like spoiled meat, is associated with gastric cancer which is undergoing ulceration. The presence of sarcinæ gives a musty odor, which is very characteristic.

Foreign Substances.—Foreign substances in the content—like blood, bile, mucus, pus, and tissue fragments—all lend their peculiar modification to its appearance. Small spots or streaks of fresh blood have no significance other than that the slight trauma of the tube has produced them. If blood is present to any extent, the color of the content becomes dark-brown to blackish-brown, or, if the bleeding has been recent and excessive, the color may be dark-red to brown. Such an appearance usually means ulcer or carcinoma of the stomach. The color may be yellow to green if bile be present, and, if constantly present, means a stenosis of the duodenum below the outlet of the common duct. The presence of bile in the fasting stomach has no significance, because of the relaxation of the pylorus, which allows the duodenal contents to come through. It is also almost universal to have the washings of the fasting stomach bile tinged for the same reason. All contents which are green do not, however, necessarily contain bile, for the growth of a peculiar mold or algæ may produce this color, and the chemical test clears this up promptly.

Presence of Mucus.—The presence of mucus has never been given the attention that it should have received, and we are now beginning to learn its significance. The mucus may arise from two sources: first, that from the mouth, pharynx, and esophagus—the “exogenous,” and, second, from the stomach itself—the “endogenous.” It is only the latter that has any significance in diagnosis, for the former is almost invariably present in greater or less quantities. Hence it is very important when mucus is present in large quantities—for the lesser are never pathological—to determine whether it comes from the stomach. As the content stands, we may note that exogenous mucus rises to the surface of the fluid and can be easily removed, while the stomach mucus is intimately mixed with the food fragments. Another method of distinguishing the two is the addition of some staining fluid—for example, brilliant green, 0.6; neutral red, 0.3, water, 30.0—when it will be found that the exogenous mucus is intensely stained, while the gastric is lightly stained or not at all. In the wash water of the fasting stomach, only that mucus is to be regarded of gastric origin as is present in the form of clear, transparent lumps, or producing a cloudiness, which under the microscope will be found to be mixed with epithelial cells from the stomach or their peculiar

oval nuclei. Whenever, then, a considerable amount of mucus of this character is found, we may regard the mucous membrane of the stomach as in a state of catarrhal inflammation, the so-called gastric catarrh, usually a secondary effect of passive hyperemia, whether due to an insufficient heart, cirrhosis of the liver, or other causes. The determination of whether the amount of mucus is pathologically increased is somewhat difficult, and cannot be done by pouring the content from one glass to another, as has been recommended, or by examining the sediment from the wash water. E. Schuetz has devised the simplest and most practical way, which is, after the mucus swimming on top of the fluid has been removed, to pour off the supernatant fluid and empty the residue into a shallow vessel, like an evaporating dish; then, with a piece of wire bent like a hook and roughened on its concave surface with a file, one proceeds to hook out of the opaque mass fragments of mucus, and from their size, tenacity, and number to reach an approximate estimation of the amount; if abundant, long strings or bands can be pulled out, but, if scanty, only a few small flakes. It has been noted that in ulcer of the stomach mucus is scanty or absent in the content. Taking this fact as a basis, it has been adduced by some that the absence of mucus, whose presence is supposed to protect the stomach during active digestion, may be pathological, and may be the cause of many gastric disorders. In particular they regard the absence of mucus as a cause of hypersecretion, but it is the experience of almost every one examining many gastric contents that these are the very instances where the mucus is most abundant. Where the opposite is true, it may be due, as A. Schmidt suggests, to the ease with which the normal mucus is digested by the superacid gastric juice. Still, there is more than a question of digestion involved, for in achylia a stomach, endowed with the same muciparous glands, secretes no mucus, and the bread crumbs float in a fluid as clear as water.

Food Fragments.—Food fragments from previous meals, especially when the test breakfast is taken fasting—that is, ten to twelve hours after the last meal—mean a considerable degree of stasis. Berry seeds, fragments of lettuce leaves, and greens have not this significance, because they leave even the normal stomach very slowly.

Tissue Fragments.—Tissue fragments, in the writer's experience, have been limited to patches of mucous membrane, usually large enough to be detected by the naked eye, though their character may be quickly verified by recourse to the microscope, and on two occasions fairly large masses of a malignant growth have been detached

and washed out of the stomach. The cause of the former, in the writer's opinion, is the collapsing of the stomach wall over the eyes of the tube as the contents flow out, and the tearing off of a small fragment of the mucous membrane as the tube is withdrawn. Meanwhile some observers have thought that injury of the mucous membrane of the stomach by the tube and removal of fragments is especially prevalent in certain diseases, and also connect with this circumstance the frequency of small blood clots in achylia gastrica, declaring that the walls of the organ are particularly vulnerable in this disease. The apparent connection is that in this disease, on account of the scanty amount of content that can be obtained, which will practically never run through the tube, too vigorous attempts are made, by moving the tube back and forth and inducing the patient to strain, to accomplish this desired result, with their consequent injury. When we are content with the few cubic centimeters which can be obtained by pinching the end of the tube and removing it, we shall see fewer and fewer instances of removal of patches of mucous membrane and small blood clots; then, too, we shall have less basis for the condition called "hemorrhagic erosion" by Einhorn. The washings from an empty or fasting achylie stomach are, however, much more likely to contain these patches of mucous membrane than of any other disease, except cancer. Hemmeter and others have attempted intentionally, by using tubes with stiff open ends, to remove these fragments, in the hope that by their histological examination we can make an earlier diagnosis of gastric cancer, but the method has not been generally used because unsatisfactory and not free from danger.

Tissue Fragments Other Than Mucous Membrane.—The tissue fragments other than mucous membrane, which are rarely found, have been mentioned, and, if discovered, are of great aid in diagnosis; but, since they have been found by the writer only twice in many hundreds of examinations, and then only in the wash water, they must be extremely rare.

CHEMICAL EXAMINATION OF GASTRIC CONTENTS.

Chemical examination of gastric contents is employed to determine whether those constituents found in a normal digestion are present, whether they are increased or diminished, and whether there exist abnormal substances, the products of bacterial activity (never discovered in a normal digestion). This method of examination, therefore, affords us a knowledge of the secretory and motor functions of the

stomach in question, and also in some cases furnishes clear diagnostic points in the detection of certain gastric diseases. In spite of the prodigious amount of literature that has accumulated on this subject, what clinicians want to know is: (1) Is hydrochloric acid present and in what quantities? (2) Are the ferments, pepsin and rennin, there? (A question which, in the author's estimation, can always be answered in the affirmative when hydrochloric acid is normal.) (3) What progress has the starch digestion made? (This is always impaired in hypersecretion.) (4) Has the protein digestion extended beyond the stage of peptones? (Amino-acids may be present in gastric cancer.) (5) Are organic acids found? (Their presence indicates gastric insufficiency or stasis, due to pyloric narrowing.) (6) Is there occult or chemical blood? Many a clinician has asked himself whether the answer to these questions has sufficient value in diagnosis to repay one for the time and trouble demanded to answer them. Some even have discarded this form of examination altogether and pronounced it of no value, but these have been men who have attempted to rely on the chemical analysis alone and have found themselves leaning on a broken reed. This method has no greater value, taken alone, than inspection, palpation, or percussion, but in conjunction with the latter proves a very valuable adjunct to diagnosis. To be of value, however, the conditions attached to the test breakfast for chemical examination must be accurately carried out—the time of removal, the character and amount of the bread and water, must always be the same, and it should be given during the morning hours, for in the afternoon the acidities are always increased, due probably to mental influence. Some authorities have attempted to belittle the chemical findings because they claim that in the same individual on different days the acid factors vary, due, as they state, to the layer formation of the food in the stomach and the withdrawal of the content by the tube at one time from the interior of the stomach and at another from the periphery, locations where the amount of acid varies. To these doubting Thomases we can only offer the experience of E. Schuetz, who found that in a large clinic successive acid determinations on the same patient differed so little that they might well be included in the realm of negligible chemical inaccuracy, due to the more or less firm adherence of the hydrochloric acid to the solid portions. Lefmann, too, has shown that, while the free hydrochloric acid factor may vary greatly, the total acidity remains fairly constant, even at months' intervals in the same patient.

Detection and Estimation of Hydrochloric Acid.—This procedure

gives us, perhaps, the most information in regard to the character and completeness of digestion in the stomach, and hence the greatest aid in diagnosis. We must first recognize, however, that this acid exists in two forms: "free"—that is, ununited to bases or protein—and "combined," which is for the most part attached rather loosely to protein, but in such a way that it cannot be detected by the ordinary reagents for the "free" acid. Of the many, many reagents suggested for the detection of the presence of the "free" acid, the writer's trust is placed in three alone: (1) Congo red, which is best employed in the form of slips of paper, much like the litmus papers, which can be purchased, or prepared by dipping slips of filter paper in a 1:1,000 watery solution of congo red and allowed to dry. When a piece of this paper is dipped in a gastric content containing "free" hydrochloric acid, it turns a more or less intense blue, according to the amount of the acid. The papers should be renewed after a few months, as they lose their sensitiveness. (2) Dimethylamidoazobenzol in 0.5 per cent alcoholic solution, Toepfer's reagent, best kept in a dropping bottle because it stains the fingers strongly, when added (a few drops) to gastric contents containing free hydrochloric acid, changes it to brownish-red or deep-red. Unfortunately, both of these reagents react not only to free hydrochloric acid, but also to organic acids and acid phosphates, so that their value is absolute only when the latter are absent. (3) Guenzburg's reagent (phloroglucin, 2.0; vanillin, 1.0; alcohol, absolute, 30.0). When a few drops are added to an equal amount of filtered or decanted gastric contents containing free hydrochloric acid, in a porcelain dish, and then warmed gently over an open flame with care lest the alcohol take fire, there arises a bright-red ring around the evaporated fluids. This test is absolute, and is not given by organic acids or acid phosphates. The congo papers are very sensitive if not too old, and will show free hydrochloric acid if present to the extent of only 0.01 per cent. The blue color shown with organic acids is not pure, but grayish-blue, and can be easily removed by dipping the paper in ether, while the pure blue produced by hydrochloric acid cannot be removed in this way. The Guenzburg reagent must be kept in a dark place and must not be too old, for with age it loses its sensitiveness. Of course the integrity of the reagent can be determined at any time by simply heating some of it with a few drops of diluted hydrochloric acid. Then, again, great care should be taken when heating that it does not char and assume a brown color. The writer's custom is to warm until the first faint red ring appears, then remove it from the flame and allow it to spon-

taneously evaporate still further, which it will do by means of the heat in the porcelain dish. The reagent is much more delicate than the congo red, and will indicate the presence of the acid when it amounts to only 0.005 per cent. The mere presence of free hydrochloric acid does not indicate that secretion is normal; that can be told only by the subsequent quantitative determination. When absent, however, under the conditions mentioned, it may mean a diminution or absence, due to disease of the glandular parenchyma. This may be the result of atrophy of the glands, associated with chronic gastritis, or of a congenital functional inactivity. The absence of free hydrochloric acid is also a characteristic of achylia, where, in addition, there is also a lack of the ferments. In such cases, too, the combined acid is very much diminished or entirely wanting. It is probable that nervous influences and the condition of the blood may cause a suppression of the hydrochloric acid, and attention has been repeatedly called to this feature in pernicious anemia; in fact, from its absence and the general cachexia of the patient, two individuals in the writer's experience have had exploratory operations for suspected gastric cancer before more careful examination showed this malignant disease of the blood. Another cause for the suppression which has come to the writer's attention several times is migraine, an observation which has been verified by Kelling. Early pulmonary tuberculosis is also provocative of suppression of hydrochloric acid, and in our student days under Boas we were especially enjoined to make a careful examination of the lungs when achylia was found. In gastric cancer there is usually no hydrochloric acid, and diagnosis by chemical aid fell largely into disrepute for this reason, because for a time it was supposed that from an absence of free hydrochloric acid in gastric contents we could immediately diagnose cancer. We have already noted the other conditions which may produce this suppression, and we now know that, when cancer is engrafted on ulcer, hydrochloric acid may persist to the end. The actual statistics, however, show that hydrochloric acid is lacking in from 71 to 84 per cent of gastric cancer, so that this feature has a decided diagnostic value, though not absolute. The cause for this suppression has been demonstrated to be the atrophy of the secreting glands, accompanied naturally with loss of rennin. The pathological and the chemical changes go on hand in hand, as has been shown by Matti, who examined the mucous membrane of the stomach from operative cases of gastric cancer. Others have attempted to explain this loss by the neutralization of the acid by the amino-acids produced by the action of a secre-

tion of the growth, which is known to carry the digestion of protein beyond the peptone stage. It has long been recognized that growths at the fundus of the stomach suppress the secretion of hydrochloric acid much more quickly and thoroughly than those at the pylorus, but this may be due to the more rapid growth and extensive infiltration of the gastric walls by the former, while the latter are slow growing and for a long time limited to this locality; hence some inference as to the site of the growth may be drawn from this incident.

Amount of Hydrochloric Acid Secreted.—How much hydrochloric acid there is, whether excessive (hyperchlorhydria) or diminished (hypochlorhydria), can be answered only by a careful estimation or measurement with an alkali solution of known strength. True, we can often, from the intensity of color, with Guenzburg's and congo red tests obtain a rough estimate of the amount, but, if we make a practice of drawing conclusions as to the quantity from the intensity of color and then check this by a quantitative determination from the disparity of these two factors acquired in this way, we shall soon be willing to follow Lowell's advice in the Bigelow papers, "Don't prophesy unless you know." The titration should be carried out, if possible, with the unfiltered gastric contents, since repeated examinations will soon show one that the acidity of unfiltered contents is almost invariably greater than that of the filtered, the reason for which is the probable mechanical union of hydrochloric acid with the undigested particles. This, too, avoids the tedious operation of filtering, and, if the content is briskly stirred while adding the alkali, thorough mixing takes place. The greatest difficulty is in accurate measurement, because the very convenient measuring pipettes cannot be used, as their caliber is too small. First, then, after removal of as much floating mucus as possible, we stir up the contents thoroughly with a glass rod, measure out 10 c.c. with a small graduate (the graduated sedimentation tubes mentioned above are very convenient) and pour it into a small beaker, or, on account of the white background for the observation of change of color, a porcelain evaporating dish. Then we add to the contents a few drops of Toepfer's reagent (dimethylamidoazobenzol) and drop into it a one-tenth normal sodium hydroxide from a burette, first noting the point at which the liquid stands, until the red color has changed to a distinct yellow and all the red has disappeared, or is similar to the color of one drop of the sodium hydroxide solution. 10 c.c. of water, and a few drops of Toepfer's reagent, and again read the level of the fluid in the burette. The difference is the number of cubic centimeters necessary to neutralize the free hydro-

chloric acid in 10 c.c. of gastric contents, and is usually multiplied by 10 to obtain the amount for 100 c.c. of content: thus, if 3.5 c.c. were used for 10 c.c. of content, the free hydrochloric acid is commonly expressed as 35. Since, however, each cubic centimeter of the one-tenth normal sodium hydroxide solution is equivalent to a cubic centimeter of a one-tenth normal hydrochloric acid solution containing 0.00365 gram of absolute hydrochloric acid, we may multiply the 35 by this factor and obtain 0.12775 gram, or 0.12 per cent hydrochloric acid. Instead of adding Toepfer's reagent to the content, we may add the sodium hydroxide solution directly to the fluid, and with a fine-pointed rod remove tiny portions and add them to congo paper until they produce blue no longer, or cause no more change in the paper than a drop of water added for comparison, the calculation being, of course, the same. The Guenzburg reagent can be used in the same way for the end reaction, but is very cumbersome.

Total Acidity.—The total acidity, if free hydrochloric acid is found, affords more information than the determination of the amount of hydrochloric acid, since, according to Lefmann, under this condition it is made up chiefly of that acid. If, however, no free hydrochloric acid is present, the total acidity may be made up of combined hydrochloric acid, organic acids, and acid phosphates. It is determined by adding to the same contents in which we have found the amount of free hydrochloric acid 5 or 6 drops of phenolphthalein solution (0.5 per cent in alcohol), and then letting the sodium hydroxide solution into it until the color becomes no redder by the next successive drop. The total acidity must be measured by the number of cubic centimeters of sodium hydroxide used for neutralization. This cannot be converted into any acid as in hydrochloric by a factor, because, as stated, it is made up of at least four different factors. Therefore, for illustration, if it took 6.4 c.c. of one-tenth normal sodium hydroxide to neutralize the acids of 10 c.c. of gastric contents, we say the total acidity is 64, meaning 64 for 100 c.c. When we combine the determination of free hydrochloric acid and total acidity as here described, we begin, of course, to read from the stand of the fluid in the burette before we begin to neutralize the free hydrochloric. The quantitative determination of the combined hydrochloric after a test breakfast can usually be obtained by simply subtracting the free hydrochloric from the total acidity, since acid phosphates are present only in the tiniest amount and negligible, while organic acids are never present with any appreciable amount of free acid. In fact, the writer's impression from hundreds of examinations is that, if we demonstrate the *presence* of

free hydrochloric and calculate the total acidity, we have learned about all that we can of the secretory function of the stomach; when, on the contrary, free hydrochloric is *not* present, a much more careful examination must be made, since the total acidity may then be made up of combined hydrochloric, acid phosphates, and organic acids. Many recommend under these conditions the determination of the hydrochloric acid deficit—i.e., the amount of this acid needed to saturate all the protein left uncombined in the content—since it is known how much of this it would require to saturate all the protein that is in the bread taken. This method of comparing a known quantity, amount of bread eaten, with an unknown quantity, ratio of bread removed to the total in the stomach at time of removal (for it is well known that the whole is probably never withdrawn), produces such uncertain results that little reliance can be placed on them. Some objections have been raised to the use of phenolphthalein because it reacts only to free alkali, and, furthermore, the alkali combines with the proteoses to a certain extent before the end reaction is shown. This demands that extreme redness be produced, but, unfortunately, for these reasons the total acidity is always found a little too high. On account of these deficiencies, litmus has been proposed for the end reaction, but comparisons of titrations, using both phenolphthalein and litmus, show so little difference that for all practical purposes they are alike.

Diagnostic Significance of Acid Determination.—The diagnostic significance of acid determinations is very little when taken alone and not in connection with other considerations. Furthermore, such findings can have value only when we are able to fix well-restricted normal limits, a feat somewhat difficult because these acidities seem dependent on racial characteristics, environment, etc., but more particularly on the desire of every clinician to somewhat modify the test breakfast, whereby no uniformity of the stimulus can be maintained, and, naturally, no uniformity of the results. The limits within which an acidity may be regarded as normal will soon be determined by every clinician from the preponderance of cases without marked gastric lesions whose acidities fall within these limits. The writer's experience would place the limits for free hydrochloric acid between 20 and 40, or 0.07 and 0.14 per cent; E. Schuetz makes the limits 20 and 60; and Zweig, 30 and 40; but the normal acidities in our clinics do not run to these extremes. As already stated, when free hydrochloric acid is present, the total acidity is to be interpreted simply as a measure of the free and combined hydrochloric, and hence only under these

conditions, can it have any value in estimating the integrity and activity of the secretory function of the stomach. Total acidity, then, according to E. Schuetz, ranges from 40 to 80; according to Zweig, from 50 to 60; and the writer's experience from clinic and private practice accords much more closely with the latter figures, so that less than 20 for free hydrochloric is regarded by the writer as a diminution and more than 40 as an excess, while the same is true of total acidities of 50 and 70. As a rule, after the test breakfast there is a sharp correspondence between the free acid and the total acidity, the difference usually amounting to 20. This difference can, however, be less in hypersecretion because, though more gastric juice is secreted, there is not a corresponding union with the protein. In deficient motility, too, the difference may be greater because, on account of the greater delay of the food in the stomach, there is a more extensive combination of hydrochloric acid with protein, a relation maintained also when there is much mucus, which also binds the free acid.

Deficient Secretion.—Deficient secretion, also called "subacidity," where free hydrochloric is less than 20 and total acidity less than 40, is associated with beginning organic disease of the mucous membrane of the stomach, "gastric catarrh," with various diseases of the blood and other organs, as described on page 52, as well as with many functional disturbances of the body (menstruation). The diminution of secretion in persons over 50 years of age, which has been given as an explanation of the so-called "senile dyspepsia," cannot be maintained if a large series of cases be examined, and in the writer's experience some of the highest acidities are found in persons over 60, which can usually be explained by the undue stimulation produced by insufficiently masticated foods. The lessened secretions so often attributed to nervous influences undoubtedly exists, but is not constant, and, if the patient is frequently examined, such patients will be found on certain days to present normal acidities.

Exaggerated Secretion.—Exaggerated secretion with free hydrochloric acid present and a total acidity of over 70 can be due to different nonpathological causes (such as excessive use of meat, alcohol, tobacco, and condiments) as well as to pathological conditions (such as the early stage of chronic "gastric catarrh"), though an excessive amount of mucus may be present. Hypersecretion also accompanies gastric ulcer, and often cancer when arising from ulcer. No doubt, too, it may arise from neurosis, but it occurs less often than is generally supposed, and to the writer offers an incentive for most careful investi-

gation regarding ulcer before being satisfied with the diagnosis of "nervous hypersecretion."

The coincidence of hypersecretion and hyperacidity has been so often noted that most investigators, including Bickel, are inclined to believe that an increased percentile acidity due to hydrochloric acid is always dependent on an increased secretion of gastric juice of normal acidity. True, no increased amount may be withdrawn, but the scanty residue indicates that the major part of the meal, with its acid neutralizing qualities, has passed through the pylorus, leaving a more nearly pure gastric juice behind, whose acidity is known to be much greater than that of the ordinary normal gastric content. Others regard the amount of mucus secreted and the alkaline secretion of the pyloric region, as described on page 36, as important factors in regulating the percentile acidity of the gastric content. Whatever may be its cause, E. Schuetz has devised a ready means for establishing a standard of comparison in which the confusing percentages play only a subordinate part, and that is to calculate the entire amount of hydrochloric acid in the gastric content by multiplying the total acidity, or phenolphthalein factor if hydrochloric acid be present, by the total quantity of content removed, and divide this by 100. Thus, to use his illustration, 120 c.c. of content with an acidity of 80, or $\frac{80 \times 120}{100}$, gives an absolute hydrochloric acid amount of 96 c.c. one-tenth normal hydrochloric acid. A gastric content exceeding this total in acidity, so reckoned, with a small percentage of solid, may be regarded as belonging to the group of hypersecretions, no matter what its percentile acid is. Some are still unwilling to give up their former views in regard to hyperchlorhydria, and sometimes it does not exactly correspond with hypersecretion, but this is probably due to our still faulty method of obtaining the total content with the tube. The hypersecretion, however, is that form which should be regarded as most indicative of chronic gastric ulcer. Hypersecretion, too, is marked by a difference between free hydrochloric acid and total acidity of 10 and less, while impaired motility is suggested by a difference greater than 20.

No mention is made, beyond this brief notice, of alizarin, for in the writer's experience, after many examinations of contents with its aid, no assurance has ever been offered him that it really indicates when all the acidities but that of combined hydrochloric acid have been saturated. Furthermore, it has no clinical value except when free hydrochloric acid is absent, and in this case titrating with one-tenth

normal hydrochloric acid is more satisfactory, but, for reasons already stated, not accurate. Perhaps it is well to state that it requires 20 c.c. of the standard acid solution to saturate the protein in the test breakfast, and, if any less than that amount is used for 100 c.c. of content to produce the congo reaction, it indicates a corresponding amount of combined hydrochloric acid, and we are not dealing with its complete absence. These determinations of the acidities do not afford diagnoses which one may read, but they do help to distinguish between hypersecretion and impaired motility, conditions requiring different modes of treatment, and in all cases indicate whether acid or alkali is more likely to prove efficacious in treatment.

Detection of Ferments.—The detection of the ferments may prove valuable provided no free or combined hydrochloric acid can be found, for, when the latter are present, the former are always found in sufficient quantities.

Presence of Pepsin.—The presence of pepsin can be readily detected by placing a piece of hard-boiled egg, cut thin with a sharp knife or razor, and punched with a small hollow key, or a flake of fibrin which has been previously soaked with a carmine solution and thoroughly washed, into a test tube with 10 c.c. of gastric contents after adding a couple of drops of dilute officinal hydrochloric acid (10 per cent); this tube is then placed in a brood oven, or suspended by a string passed into the mouth and held by a cork in a bath at 38° to 40° C., where it is allowed to remain two hours. The entire or partial solution of the egg or the staining of the fluid red by the carmine indicates digestion and likewise pepsin.

Quantitative Determination of Pepsin.—The quantitative determination of pepsin is also a laboratory refinement, and has no clinical value in the writer's estimation, although the easiest and most practical method, that of Gross, will be given here. We first prepare a solution of 1 gram pure casein, 16 c.c. of 25 per cent or 12.5 c.c. of 31.9 per cent (U. S. officinal) hydrochloric acid and one liter of water, which can be hastened by warming on a water bath. From this stock solution, which can be kept indefinitely in a cool place, 10 c.c. are placed in each of five or six tubes; then into the tubes, whose contents should be warmed to 39°-40° C. in a water bath or brood oven, beginning with 0.01 c.c., increasing quantities of the gastric content should be placed, so that the series shall contain respectively 0.01, 0.02, 0.03 c.c., etc. This can be readily done with a 1-c.c. pipette graduated to hundredths. These tubes are then allowed to remain in the brood oven or water bath at 39°-40° C. for fifteen minutes, when they are removed and a few

drops of a saturated solution of sodium acetate are added to each. In those in which the casein is undigested a cloudiness to a perceptible precipitate of casein will form, while those in which caseose or digested casein is found will show no cloudiness. Normal gastric juice in amounts of 0.02 to 0.03 c.c. will contain enough pepsin to digest the amount of casein present in 10 c.c. of the mixture. The pepsin units into which these results are sometimes calculated are only a laboratory refinement.

Detection of the Presence of Rennin.—The detection of the presence of rennin offers but little more evidence of the integrity of the secreting power of the stomach than that of pepsin, and is valuable only when hydrochloric acid is absent; in fact, Pawlow insists that these ferments are one and the same. A combined qualitative and quantitative determination of rennin can be readily carried out by measuring out 1 c.c. of filtered gastric contents into a 10-c.c. graduate and adding water to the mark 10; then pour half of this into a test tube and fill again to 10, revolving the graduate in the hands to thoroughly mix the fluid; again, pour out half of this into a test tube and refill to 10 until 4 tubes are prepared, which will contain dilutions of contents, 1:10, 1:20, 1:40, and 1:80; now add to each 5 c.c. of milk a drop of 1 per cent calcium chloride solution, and we have dilutions of 1:20, 1:40, etc. These tubes are then placed in a brood oven or water bath for twenty minutes and then removed. If rennin is normal, dilutions of 1:80 and often of 1:160 will be found coagulated; if diminished, only 1:20; and if absent, of course, none. The special advantage derived from the detection of both pepsin and rennin is that their secretion is less under the influence of emotion and mental influences, but, as we are recognizing more and more that the emotions suppress the secretion of gastric juice as a whole and not any element of it, these distinctions have less basis for their existence. Furthermore, in pathological conditions of the stomach—achylia from pernicious anemia, cancer, and chronic gastritis—pepsin and rennin often persist when the secretion of hydrochloric acid is wholly suppressed. Hence the entire absence of pepsin and rennin means an extensive destruction of the entire glandular structure of the stomach. Lefmann's opinion is that, in spite of extensive efforts on the part of many investigators to utilize our knowledge of the enzymes in a clinical way, they must always take a subordinate place in importance to the hydrochloric acid values. As has been stated, the detection of pepsin has no value when hydrochloric acid is present to any extent, for practically all investigators have found that quantitatively

they run side by side. When, however, the acid is wanting, the discovery of pepsin indicates that the glandular structure of the stomach is still, to a certain extent, intact. If the qualitative test for pepsin is faint or indistinct, then it is well to perform the quantitative estimation. When pepsin cannot be found, it is always necessary to seek for rennin before deciding that the secreting function of the stomach is wholly lost, for the latter enzyme is much more persistent. Nor should we fail to bear in mind that pancreatic juice, which can coagulate milk, may come through the pylorus with the duodenal contents and rennin be discovered in a pepsin-free stomach, particularly in achylia, when not an atom of it was secreted there. The fat-splitting ferment of the stomach, if it exists—and many still insist that it is the ordinary pancreatic steapsin which has wandered through the pylorus into the stomach—has so far acquired no clinical significance.

Starch Digestion.—To what stage starch may be digested may often answer the question of how much hydrochloric acid is secreted. If to filtered gastric contents we add 1 or 2 drops of Lugol's solution and find the blue color due to amidulin, we say that the acid is increased; if there is no color other than the yellow of the iodine, we say that the acid is relatively diminished, because we know that 0.07 per cent of mineral acid inhibits the action of ptyalin, while 1.2 per cent destroys it; when the acid is combined with protein, as shown by the writer,¹ the digestion of starch in the stomach is not at all interfered with. This law does not always hold true, for an active gastric juice must be present to liquefy the envelope of gluten, so that the ptyalin or animal diastase may attack the starch. Thus, in achylia it may be possible, on addition of Lugol's solution to find the yellow perfect starch digestion, when actually the starch has not been attacked. Under normal conditions of acidity we are apt to find the amethyst of erythrodextrin; meanwhile we may find normal acidities where the color remains blue, and hyperacidities where the color is red, the opposite of what we should expect. The apparent reason for this paradox is, first, the difficulty in determining accurately the amount of acid in the stomach, and, second, the so-called layer formation, by which starch digestion next the stomach walls is quickly checked, while that in the interior may be continued for a period of two hours or more.

Detection and Measurement of Proteoses.—The detection and measurement of the proteoses in gastric contents do not offer enough information that can be made clinically available to pay for the effort.

¹ *Boston Med. and Surg. Jour.*, June 29, 1899.

This is a retraction of views expressed by the author¹ some years ago, based on many examinations which appeared full of promise for the measurement of motility, but did not materialize on longer experience. The detection of tryptophan by adding bromine water or bromine fumes to filtered gastric contents and the consequent production of a violet color, either immediately on removal or after being kept twenty-four hours in a warm place under toluol, is very significant if the presence of duodenal contents can be excluded from the stomach (absence of bile pigment), for it shows that the digestion of protein is carried beyond the stage of peptone to that of peptid, of which glycyltryptophan is one, a feat that, apart from trypsin and bacteria, can be accomplished only by the secretion of a malignant growth, as Fischer has shown. In the writer's clinics this test is made a routine part of the examination of gastric contents when hydrochloric acid is absent, as described by the writer.² The presence of bile in the contents of the stomach, indicating at the same time trypsin, would, of course, be an insurmountable objection to the employment of it for the detection of tryptophan.

Fatty Acids.—The fatty acids, chiefly acetic and butyric, give a rancid odor to gastric contents, and if, on warming the contents, a piece of blue litmus paper, moistened with water, is held over them, the paper will redden on account of the fumes thrown off. They have no significance beyond indicating that there is a certain degree of stasis.

Lactic Acid.—Lactic acid has much more significance if no meat—whose inherent lactic acid may be extracted to such an extent that it readily gives the reaction—is present in the gastric contents. Of diagnostic value is only the fermentative lactic acid obtained from carbohydrates, which, according to Boas, is produced solely by the "thread" or long bacilli. For reasons mentioned, gastric contents in which meat fragments are found are not suitable for examination for lactic, nor are the washings of the stomach after the evening Riegel meal, but after the stomach is well washed out the presence of lactic acid in the gastric contents of the test breakfast following is very suggestive. Perhaps in this case, since the acid is produced in stagnating contents, it is well to wait two or three hours before their removal. As the activity of the bacilli is inhibited by 0.02 per cent of hydrochloric acid, it is unnecessary to look for lactic acid when hydrochloric acid is frankly present. Some breads also may have a trace of lactic acid, so that, where it is found in the contents, it is well in a

¹ *Med. News*, lxxvii, 806.

² *Med. Record*, Aug. 19, 1911.

watery extract of the same bread to employ the test. Lactic acid can be best detected by adding a drop of 1 per cent ferric chloride to each of two test tubes of like caliber filled with water, emptying the solution and again filling with water, when the desired dilute solutions can be obtained, to one of which a few drops of the filtered gastric content are added, while the other serves as a control. Placed over a white surface and looked at along the length of the column of fluid, the tube containing the gastric contents has a bright canary-yellow color if lactic acid be present. The reaction can be made sharper by adding to each tube a few drops of 4 per cent carbolic acid, according to Uffelmann, or until an amethyst color is produced, whereupon the gastric contents are added in the same way. Of course the change from amethyst to yellow is much more distinctive, for the iron solution always assumes a dull yellow, which rapidly darkens on exposure to air, so that results must be determined at once. Unfortunately, at times the gastric contents present a yellow color, which makes the test very confusing, and in this case it is better to extract some of the filtrate with a little ether and use the ethereal extract for the test. This can be readily done with a test tube and the thumb for a stopper, and is greatly aided by adding a drop or two of phosphoric acid before the extraction. Apart from the bread mentioned above, we must carefully inquire whether the patient has recently (within twelve hours where stasis is probable) eaten cheese, cabbage, cucumbers, grapes, apples, or lemons, or drunk milk or wine, all of which contain either lactic acid or an acid which will give the same reaction. Tartaric acid, too, as it is used in the effervescent mixture, will also give this reaction, and the test breakfast should not follow the inflation. Many of these precautions were unknown to the writer several years ago when, in a published investigation¹ of a purely protein test meal, attention was called to the frequency of lactic acid and doubts were expressed as to its diagnostic significance, but it is apparent that none of the precautions mentioned can be safely neglected.

Significance of Lactic Acid.—The significance of lactic acid is that the hydrochloric acid is very much diminished and that there is stagnation of gastric contents. As these conditions occur, however, most frequently in gastric cancer, lactic acid has come to be regarded as an almost pathognomonic for that disease, an importance which never should have been given to its presence. On account of the numerous sources of error, the actual presence of the "long" bacilli which precede the formation of the acid, either in gastric contents or in the

¹ *Boston Med. and Surg. Jour.*, 1913, 467.

feces, is of vastly more importance. It occurs to one at once that only when the malignant disease is at the pylorus, or extends to that organ, are the conditions for the production of lactic acid (absence of hydrochloric acid and pyloric narrowing) ideal, perhaps due to the uneven surface of the growth or perhaps to the blood present, and this is generally true, although one case has occurred in the writer's practice where the growth as determined by operation was at the lesser curvature and the pylorus was not involved, yet moderate stasis and lactic acid were present. When all these precautions are observed, lactic acid is practically never found except in malignant disease of the stomach. Statistics show that different observers have found that 84 to 95 per cent of all cases where lactic acid is present have cancer, while, on the contrary, on account of the different sites many cases of cancer have no lactic acid.

Presence of Occult Blood.—The presence of occult, or, as some choose to call it, "chemical blood"—that is, what is not visible to the naked eye, but can be detected by reagents in gastric contents—on account of the ease with which the mucous membrane can be injured by the tube and a tiny hemorrhage follow, is of practically little value, but does possess great importance when detected in feces, and hence the discussion of the test will be deferred to the next chapter.

Salomon Test.—The Salomon test has also been employed in the detection of early gastric cancer, but the hopes held out by its originator have not been justified. It was based on the amount of protein material found in the washings of the fasting stomach as determined by the Esbach albuminometer. The stomach was to be washed out at evening and again the next morning with 400 c.c. of physiological salt solution, and when the albumen content in the solution, as measured by the instrument mentioned, rose above 0.1–0.5 of a part per thousand, the patient was strongly suspected of having cancer. R. Schmidt well remarks that, as a positive result rests on a serous discharge of the growth, it may be as well given by ulcer, chronic gastritis, and even swallowed saliva, while in his experience it has proven negative in advanced cases of true cancer. The writer's own experience is limited to always testing the morning washings of the fasting stomach without the evening cleansing, which, in an ambulatory clinic such as the writer's, is very difficult to carry out, but the results have never been such as to convince him that the method has a practical diagnostic value. It seems to the writer that the positive outcome of the test is coincident with the so-called "minimal retention," which, as has been proven by the experience of all, is not to be necessarily as-

sociated with cancer. With the biological tests other than the splitting of glycyltryptophan, which has been described, the writer's experience is nil, and until their technic is much simplified they will be impracticable for the use of the clinic, nor have their results been such as to invite extensive use.

MICROSCOPIC EXAMINATION.

The microscopic examination of gastric contents includes a search for food particles, red and white (pus) blood corpuscles, epithelial



Fig. 25 Food particles *a*, starch granules *b*, gluten structure *c*, meat fibers with and without air spaces, *d*, fat in needles and globules, *e*, vegetable residue (E. Schuelz)

cells and their nuclei, yeast spores, bacilli, and tissue fragments. This method is placed last, not because it is less important under certain conditions (stasis and minimal retention), but because in the majority of cases, with normal motility of the stomach, nothing can be learned from it beyond what can be learned from the means already mentioned, and it is not made a part of the routine examination. This examina-

tion may be made either on the content of the digesting or fasting stomach, or better, on the wash water of the latter, since it is not always possible to obtain material from it with the tube alone. When pathological elements are present in the stomach, they will appear in the contents after a test breakfast, but so obscured by the abundance of food particles that they require special care for their detection. In the wash water it is a different matter, and by sedimentation and centrifugation, as described on page 138, we are enabled to obtain a most desirable sediment for this purpose.

After the test breakfast or the evening meal, when stasis is present, there will be found in the content or the wash water, respectively, round or oval starch granules, usually with the concentric lines, when there is sufficient hydrochloric acid, or without them when the acid is

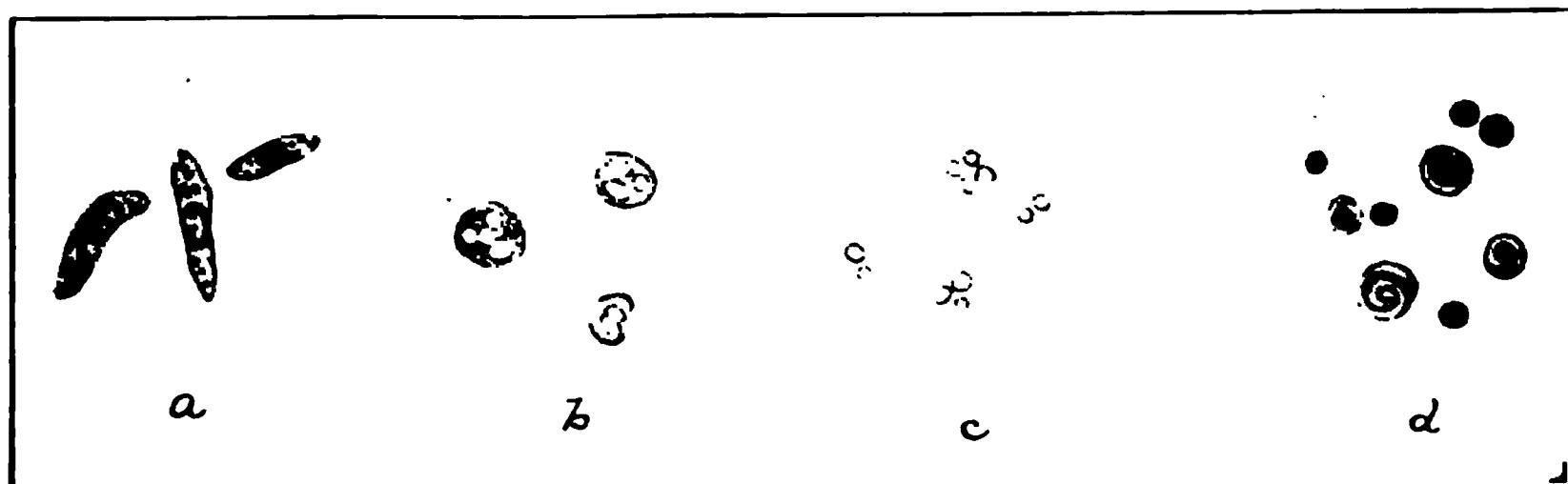


Fig. 26.—Pathologic indications. *a*, epithelium from the gastric mucous membrane; *b*, leucocytes; *c*, leucocytes embedded in mucus; *d*, mucous spirals. (E. Schuetz).

diminished or lacking. On the addition of a drop of Lugol's solution these granules become blue if hydrochloric acid is present in normal amounts, but yellowish if the acid is deficient. In contents which are poor in hydrochloric acid the gluten which contains the starch granules may often be seen in the form of net-like masses. The presence of all other elements, if the test breakfast were taken fasting, points to retention, unless possibly a few fat globules, which may be derived from that often added to bread, and various fragments of plant structures. Among these evidences of retention are to be regarded the meat fibers, whose well-retained striations are also indicative of lacking digestion. Only an abundance of fat after either meal is to be regarded, for reasons mentioned, as evidence of stagnation.

Epithelial cells are very common, consisting of large pavement cells from the mouth and pharynx, which have no interest for us, and the cylindrical cells, with their smaller oval nuclei (Fig. 26, *a*), often only a group of the nuclei embedded in mucus, the bodies of the cells having been digested.

Red Blood Corpuscles.—Red blood corpuscles and leucocytes are of little significance if only a few specimens are present. The former are almost invariably found when the tube is used, and the latter come from the posterior nares or pharynx. When the hydrochloric acid is scanty, the body of the cell remains, but, when normal or abundant, only the nuclei are left after the digestion of the body and are usually in groups of three or four embedded in mucus (Fig. 26, a). It is sometimes rather difficult to distinguish between the nuclei of the pavement cells after digestion of the body and the leucocytes before digestion of the body, but, if we remember that both are digested simultaneously and that, if we come across the nuclei of the digested pavement cell, we must necessarily find the multiple nuclei of the leucocyte without body, we shall make no error.

MICROORGANISMS.

The microorganisms found of importance are usually restricted to yeast spores, sarcinæ, and the long or "thread" bacilli. The yeast spores are always found in contents, but gain significance only when found in long chains or in groups, and then indicate stagnation in the stomach. Their growth is not restricted by free hydrochloric acid, and they may be found very numerous in hyperacid contents.

Sarcinæ.—The sarcinæ appear in groups of four, sixteen, and sixty-four, like bales of cotton, or rarely single (Fig. 27, a), in conjunction with yeast and free hydrochloric acid. They signify a marked degree of stagnation, usually due to pyloric stenosis, which is often, but not always, benign. Of the bacilli, the thread-like forms possess the only real diagnostic value, and a thick bacillus is sometimes described as present in putrefactive processes associated with cancer, but they have never been observed by the writer. The "thread" bacilli are probably the producers of lactic acid, and have been variously named the Boas-Oppler, lactic acid, and long bacilli. Their association with this acid is undoubted—whether as cause or effect is not fully known. They assume zigzag and whiplash shapes, and to be of importance must exist in large numbers and not in isolated examples. The significance of the presence of *numerous* long bacilli is much that of lactic acid (absence of hydrochloric acid and stagnation of gastric contents), and, as these conditions occur most frequently with pyloric stenosis, due to malignant growth, their presence has come to bear the more liberal and partially unjustified interpretation of gastric cancer. R. Schmidt has summed up the diagnostic value of the "thread" bacilli

in several postulates, which are here given: (1) The absence of these organisms cannot be utilized as contraproof to the existence of cancer, which may go on to a fatal termination without their presence. (2) The growth of this group of organisms varies largely in intensity in the stomach, but is much more even in the feces, where it is always found when present in the stomach, and sometimes even more

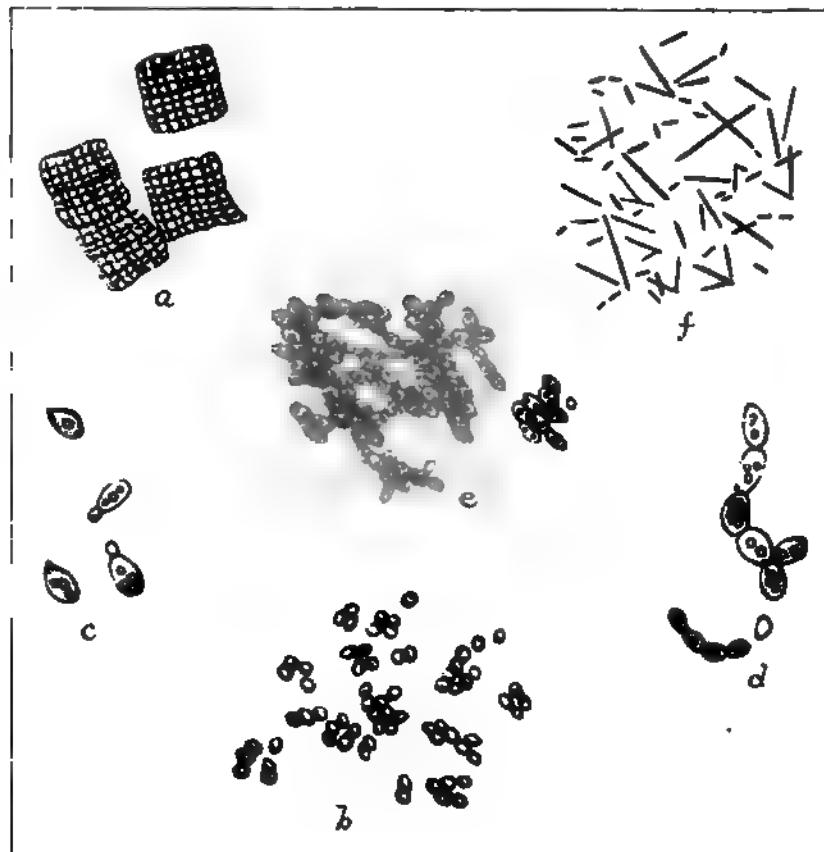


Fig. 27.—Microorganisms: *a, b*, sarcinae in pairs and clumps; *c, d, e*, yeast spores, single, in chains, and in groups; *f*, long ("thread") bacilli (E. Schmetz.)

luxuriantly. (3) Only rarely are the bacilli found in the feces when not of gastric origin (Schmidt has seen one case of lymphosarcoma of the duodenum and one of tuberculous stricture of the lower ileum, and one of annular carcinoma of the descending colon has been seen by the author). (4) The presence of a vigorous growth of these bacilli in the gastric contents comes, with rare exceptions, only in

case of cancer. (5) In noncarcinomatous disease of the stomach they have been found in only three cases—callous narrowing of the pylorus due to acid poisoning, cancer of the gallbladder, and callous pyloric stenosis due to a renal tumor, in all of which cases there was "coffee-grounds" vomiting. (6) Isolated examples of "thread" bacilli, especially in sepsis and peritonitis, do not possess any diagnostic value. (7) The absence of the bacilli with "coffee-grounds" vomiting (present in hypersecretion, benign pyloric stenosis, gastric crises, intestinal stenosis, peritonitis, and blood stasis catarrh) can generally be utilized against the existence of cancer. The microscopic examination of the sediment from the stomach washings forms a most satisfactory method of detecting stasis, and the objects found may vary from a few rice grains to a specimen of all the objects already mentioned. As previously stated, the presence of a few rice grains may occur in a stomach with normal motility, but any considerable number of these, accompanied by fat or muscle fibers, indicate a considerable degree of stasis. Whenever isolated examples of the lower organisms—sarcinæ, yeast fungi, and "thread" bacilli—are found in the gastric contents following the test breakfast, the washings of the fasting stomach are likely to show these objects in large numbers. This is particularly true of the bacilli, and hence the microscopic examination of the fasting contents or the wash water assumes a great diagnostic value. When the wash water of the fasting stomach constantly contains meat fibers, fat, starch granules, and yeast spores in groups, or sarcinæ, we are justified in our conclusion that there is a marked gastric insufficiency, and, if these objects are present in large numbers, that there is a pyloric narrowing. At least, when washing fasting stomachs, we should never rely on the unaided eye alone to determine the presence of residue, but apply the microscope.

Many methods have been suggested for testing the functions of the stomach without the aid of the sound—the pearl tests of Einhorn, the desmoid test of Sahli, the soda test of Fuld, for the detection of free hydrochloric acid mentioned on page 103, and the connective tissue test of A. Schmidt. Of all of these only the last has been of any aid to the writer, and, as described in his article,¹ that also has left the writer in the lurch, and Schmidt himself has been obliged to modify his original statement that, where abundant connective tissue appears in the stool after 100 grams of chopped meat, slightly cooked, is taken daily by the patient for three days, it indicates absence of or marked diminution of the hydrochloric acid of the stomach. Hence,

¹ *Boston Med. and Surg. Jour.*, clxiv, 10.

as none of these have proven themselves practicable after being thoroughly tested, and have been the source of much discussion and largely unfavorable comment, they will not be given here. The detection of numerous *sarcinæ* in the feces points directly to gastric stasis, due to pyloric stenosis, and indicates that hydrochloric acid still persists, which stenosis may, of course, be benign, or, as explained, due to malignant disease in an early stage.

CHAPTER VI

EXAMINATION OF FECES

The character of the feces depends, of course, on the nature of the food, and we can compare the feces of two individuals only when they are both taking the same food in approximately the same amounts. Under pathological conditions the influence of the food becomes still more prominent because, on account of impaired absorption, much more food residue of one or all classes—fat, protein, and starch—appears in the feces. Furthermore, the desquamative products of the intestinal mucous membrane—epithelial cells and mucus—which, under normal conditions are barely perceptible, begin to form a considerable part of the mass of the feces. When the choice of food is left to the patient's whim, so many foreign and bizarre structures of varied vegetable origin appear that those most widely familiar with the microscopic appearance of feces are often puzzled. Hence, since the establishment of the character of a "normal feces" dependent on a constant diet has been established largely through the labors of A. Schmidt and Strassburger, we have followed very closely the test diet prescribed by the former. This diet has no merits above any other which any clinician may devise for himself, except that he must first examine the feces of many hundreds of normal individuals on his own diet, work which has already been performed by Schmidt on the diet usually named after him. Now, apart from this advantage, we find that this diet is suitable not only for healthy individuals, but can be borne by those who do not have a sound intestinal tract; that it is sufficient in calories for the sustenance of every patient, and that it contains the three groups of food elements—carbohydrates, fat, and protein—in the right proportion. The author suggested a diet to be followed for a strictly quantitative chemical examination of feces,¹ but the diet proved too monotonous and the chemical examination too cumbersome for clinical work, so that in recent years recourse has always been had to the Schmidt diet and the microscopic or micro-chemical examination of feces. The objections often offered to the Schmidt diet are that it contains too much milk, borne badly by some

¹ *Phila. Med. Jour.*, Sept. 22, 1900.

patients, and that its use becomes obnoxious, but the author's chief difficulty has been that with many patients it was too copious and they declared it was physically impossible to ingest the amounts given. In such diseases as appendicitis and intestinal stenosis it is not well to employ the diet, and possibly in other conditions, until an examination of the stool with the often faulty diet indulged in when, after the Schmidt diet is employed, it is sometimes surprising to see marked changes for the better from the diet alone—movements previously induced only by laxatives become spontaneous and mucus largely disappears. A well known professor in a leading university used to remark that the only thing for which he was noted was that he had never devised a modification of Tarnier's forceps, so, also, few are distinguished for not having modified the Schmidt diet, but the one given here is only somewhat changed to avoid the five meal schedule, difficult for our people to carry out, while express permission is given by the originator to make this change:

DIET LIST FOR TESTING INTESTINAL FUNCTIONS.

Breakfast.—A large cup or bowl of tea or coffee, half milk; a roll, with butter; a large saucer of oatmeal, with cream and sugar, if desired; and a soft-boiled egg. (It is better to sift the oatmeal through a sieve before cooking.)

Dinner.—A large portion of Hamburger steak, cooked with butter, but so prepared that the interior shall be rare ($\frac{1}{4}$ pound should be eaten); and at least 4 tablespoonfuls of mashed potato, also passed through a sieve.

Midafternoon.—A roll well-buttered, and a large cup of tea or cocoa, half milk.

Supper.—A roll or slice of toast, with butter; a large glass of milk; and two eggs scrambled, with butter.

The patient may drink as much water as is desired between meals. This diet is to be continued for three days, and on the fourth morning the stool is to be saved in a Mason jar. If the bowels do not move daily, use a plain injection of water, but no laxatives. The dinner here given and the supper may be interchanged.

When the stool is first seen in the Mason jar (or any other fruit jar which can be tightly sealed), we note first whether it is solid, semi-solid, or liquid, whether it is dark or black in color (iron, bismuth, or digested blood), normal color or colorless (gray, clayey, etc.), whether any mucus may be adherent, and whether fresh blood streaks are found upon it. If colorless, a bit of the feces may be mixed in

a test tube with alcohol, the alcohol poured off or filtered, and the Ehrlich aldehyde reagent added (dimethylamidoazobenzolaldehyd, 2.0, and acid hydrochloric concentrated, 100.0). Then a pinch of powdered thymol, which destroys all odor, is added to the stool in the jar, water is then poured into it, and with an egg beater that will enter the jar the whole is made into a homogeneous mixture. Into this a piece of litmus paper is dipped and the reaction determined, when often small fragments of partially digested mucus (frog spawn) come to light, swimming on the fluid, or fragments of connective tissue. Our examination may be very much facilitated by pouring out some of the mixture into a soup plate, blackened on its inner surface. Then from this mixture three drops are to be placed on as many glass slides, or, for rapid work, a tiny fragment of the original stool may be smeared on a slide and well rubbed with a drop of water, cover glasses placed over them, and the redundant fluid removed by filter paper. One slide is to be examined under the microscope directly; the second to have a drop of Lugol's solution (iodine, 1.0; potassium iodid, 2.0; distilled water, 50), for distinguishing starch residue, placed alongside the cover glass, when, by capillary attraction, everything underneath is uniformly stained; while the third is to be treated with a drop of a watery solution of nile blue sulphate for distinguishing neutral fat, fatty acids, and alkaline soaps. Then, with the "mucus hook," described on page 144, we fish out any fragments which resemble mucus or connective tissue, which in small fragments cannot be distinguished by the naked eye, and place such a fragment on a slide, cover with a cover glass, as before, and add a drop of the "brilliant green-neutral red" solution, described on page 143, alongside of the cover, and examine; then the liquid mixture may be poured through a sieve for the detection of gallstones or tapeworm fragments. For the test for occult or chemical blood, which will be described later, this diet is, of course, unsuitable on account of the meat, and, if there is any suspicion of ulcerous processes in any part of the entire tract, the patient should take a good dose of castor oil (20 c.c.), refrain from meat, fish, soup, or beef extract for three days, and then collect the stool for the blood test. If eggs or cheese be substituted for the meat in the Schmidt diet, the stool serves very well for the determination of intestinal function and detection of blood, except that we learn nothing about the digestion of meat. At least, before a positive reaction for chemical blood is accepted, the patient's statement that no meat has been taken must be verified by a search for meat fibers with the microscope.

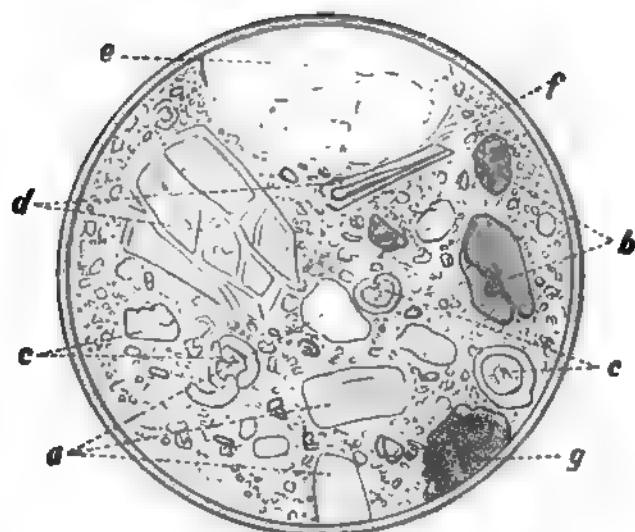


Fig. 28.—Microscopic appearance of normal stool on test diet. *a*, muscle fiber remnants; *b*, yellow lime soaps; *c*, white lime soaps; *d*, epidermal grain fragments; *e*, empty potato cells; *f*, detritus; *g*, cocoa residue (A. Schmidt).



Fig. 9. Gross appearance of stool containing excess of connective tissue.

GENERAL CHARACTERISTICS.

General characteristics of the feces first include the *amount*, which in normal individuals on this test diet reaches on the average 251 grams daily, of which 21 per cent is solid. The enormous increase, in certain diseases of the organs associated with intestinal digestion, as well as of the intestine itself, can be seen in the following figures: fermentative dyspepsia, 770 grams; achylia gastrica with diarrhea, 527.5; closure of common duct, 944; suppressed pancreatic juice, 2868.5; severe enteritis, 2,780. On the contrary, in persons who are constantly constipated the daily amount of feces is much diminished—often to 129.3. Many patients complain of insufficient stool, but careful investigation usually shows that the stools are numerous and scanty (according to Boas, "fractional stool"), and that the total is up to the average; or there may be colon spasm, which gives the sense of insufficient emptying of the lower bowel. Generally the frequency of the stools corresponds to the amount, but in enteritis there are frequent small stools with tenesmus, and in women with lax abdominal walls enormous accumulations may be found in the rectum and sigmoid, while they still declare that the bowels move daily. When stenosis of the lower bowel is present, the amount of feces is very much diminished, while the stools are very numerous. In a patient recently under the author's care, with stricture of the descending colon above the iliac crest, eight to ten stools occurred daily. One may say, on the whole, that a movement in more than every two days, or more than two daily, are abnormal.

CONSISTENCY OF STOOLS.

The consistency of stools has been mentioned, and the solid stool, containing scybala, is significant of long delay in the colon, while the semisolid and liquid stool, both abnormal, are due not so much to lack of absorption on the part of the intestine as a lively watery secretion by it, such as is produced by saline laxatives. The "lead pencil" or "ribbon" stool have no certain connection with stenosis, for they may occur in spastic conditions of the lower bowel, cramp from anal fissure, etc., and when insufficient food is taken, while, on the contrary, strictures may sometimes be accompanied by formed stools or, more often, by diarrheal stools. One can rarely rely on the patient's statement of diarrhea. For instance, in inflammatory processes in the rectum or sigmoid there may be several movements daily, consisting

of mucus, blood, and serous fluid, only once or twice daily mixed with fecal matter, or there may be only one very watery stool daily. Both conditions are accounted diarrhea by the patient, and it is often exasperating that it takes so much questioning to learn the actual number and consistence of the movements from the patient. Perhaps the best way is to ask the number of stools daily and then be shown the stool. The "nervous" increased peristalsis of the intestine occurs with almost no disturbance of the mucous membrane, while ordinarily exaggerated intestinal motility is dependent on irritation due to abnormal contents—as, for instance, the meat fragments in gastric achylia, local processes (as inflammation of its mucous membrane), or ulcer, or blood poison (as in uremia or sepsis). Watery, bad-smelling stools may be present with catarrh of the large or small intestine, but in the latter case only when the colon is involved, since it is the function of this part of the tract, and particularly its first portion, to solidify the feces by the process of absorbing the water contained in it; in fact, this decision as to whether the large, small, or both portions of the tract are effected, considered fully by the author in an article,¹ is one often of great difficulty. In general, we may say that when no large amount of unabsorbed food remnants, bilirubin, nor partially digested (frog spawn) mucus is visible, the difficulty is confined to the colon. Infrequently hard stools with scybala, or pasty stools containing the latter, indicate that the difficulty is confined to the colon, though even here microscopic examination will show numerous evidences of involvement of the small intestine in the presence of abundant food remnants, and finely divided mucus with partially digested epithelial cells and cell nuclei embedded.

COLOR OF FECES.

The color of the feces on a predominating milk diet is light-yellow, much like that of an infant, while when meat is in excess the stool is dark. On the test diet light-yellow predominates, while, if spinach or lettuce is taken largely, the stool has a distinctly green color, not to be differentiated from bile-stained feces after they come in contact with the air. All of these confusing characteristics can be avoided by the test diet with *no medication*, for calomel imparts a green color, and rhubarb and senna a yellowish-brown. The most characteristic of all colors is the gray or "clayey," which is found in obstruction of the common duct or absence of pancreatic juice from the duodenum,

¹ *Boston Med. and Surg. Jour.*, clxviii, 6.



Fig. 30. Microscopic appearance of meat fibers in stool well stained by hydrobilestain.



Fig. 31. Microscopic appearance of trout eggs in shell stained with trichloro-sulphate
a—meal grains, b—plant fragments (Chlorophyll)

either from blocking of Wirsung's duct or destructive processes in the pancreas itself, as well as those of the mesenteric glands. As these colorless stools usually contain a large excess of fat, they are always salvelike in consistency. All colorless stools, however, are not associated with absence of bile pigment (from which the natural color stercobilin is formed) from the tract, for reduction of the pigment by bacteria may be so active that a colorless product (leucobilin) may result. Such a stool, however, rapidly darkens on exposure to light, or the alcoholic extract, when a few drops of the aldehyde reagent described on page 168 are added to it, gives a bright cherry-red color. The black or tarry stool, when neither bismuth or iron has been taken, is always proof of bleeding in the upper intestinal tract—that is, anywhere from the duodenum to the sigmoid; below that point blood maintains its characteristic color, though when peristalsis is much exaggerated blood from above this point may be red. Most frequently, however, the amount of blood is so slight (as from a chronic ulcer) that it gives no color to the feces and can be detected only by a chemical test, which should never be neglected when any suspicion of ulcer or cancer exists.

ODOR OF FECES.

The odor of the feces is dependent on the indol and skatol, as both are the products of the putrefactive action of bacteria on protein, which is inhibited by hydrochloric acid. The author was, however, able to show that the effect of the acid of the stomach did not extend beyond the pylorus, and that its amount bore no relation to the quantity of these aromatic products in the feces.¹ Some errors which prevail about the odor of stools should be corrected. The odor of the clay-colored stool is not unpleasant, being at most that of fatty acids (rancid butter); that of the stool in fermentative intestinal dyspepsia is sour, and very often the contents of the container are under pressure and nearly blown out of it when the cover is removed, which should always be done under a towel. The stool on the test diet has almost no odor, while the odor when there is a disintegrating cancer of the lower bowel is most penetrating, highly putrefactive, and nauseating. Boas calls it "Aashaft," but a similar odor may be sometimes found where there is a large meat residue in the stools with active putrefaction. Excessive mucus in the stool without putrefaction may give a glue-like odor to feces.

¹ *Boston Med. and Surg. Jour.*, Dec. 17, 1903.

FOOD FRAGMENTS.

The food fragments, when macroscopic examination is made of feces, where the patient is not on the regulated diet, form a large residue, consisting of connective tissue from the tough meats of old animals (often called "canners"), bits of egg shells, fish bones, fragments of intercellular plant tissue from lettuce, celery, and spinach, skins and seeds of berries, and of pease and beans, especially when old. The well-known breakfast foods are noted for abundant residue in the feces, which reminds one of Du Bois Raymond's retort to a student who mentioned castor oil as one of the fatty foods, "that it must be a negative food." This material can usually be detected with the naked eye, but with the test diet, apart sometimes from large masses of connective tissue in gastric achylia, practically nothing can be identified by the unaided eye, and we must have recourse to the microscope. It is true that the degree of mastication affects to a certain extent the macroscopic residue, but ordinarily any considerable amount of gross objects in the stool, if the diet has been closely adhered to, is pathological.

NORMAL STOOL.

The normal stool under the microscope in the native preparation of the slide, Fig. 28, shows a few well-rounded yellow meat fibers (*a*), usually without striations; white (*b*) and yellow (*c*) calcium soaps, the latter stained with hydrobilirubin; cellulose from bread and cocoa (*d, g*); and a few empty potato cells (*e*). The Lugol and nile blue sulphate solution slides show nothing characteristic, except that in the latter meat fibers are stained light-blue and plant fragments green. When any doubt exists in regard to the character of the lime soaps and they assume most varied shapes, a little of the stool should be mixed with a drop of acetic acid on the slide, warmed, cooled, and examined. The lime soaps will be replaced by fat globules.

PATHOLOGIC STOOL.

The pathologic stool often shows grossly numerous fragments of a yellowish-white color, which may be so numerous as to present the appearance of gossamer. At first one is in doubt whether he is dealing with mucus or connective tissue, but the microscope shows the former to be studded often with fragmentary epithelial cells or



Fig. 1. Fat clumps in stool-free (from test diet). *a*—fat clumps; *b*—acids flakes
(A. Schmidt).



Fig. 31. Gross appearance of fatty stools with disturbed absorption. (A. Schmidt.)

their nuclei, well brought out by neutral red, and the latter by well-stained meat fibers. Furthermore, a drop of 30 per cent acetic acid may be added to such a shred when in doubt, which will bring out distinctly the lines extending along a mass of mucus, but will obliterate those in connective tissue. Certain vegetables, like lettuce and spinach, when the individual is not on the test diet, may confuse one from their resemblance to both these objects, but the tracing is much less delicate, there are cross lines, and the whole is unaffected by acetic acid. Reference has been made to the occurrence of these connective tissue remnants and their significance, and, while the matter is not wholly settled, A. Schmidt still insists that the material is digested only by the gastric juice, and when present in any amount indicates an impaired gastric function, usually diminution or absence of hydrochloric acid. This is true in real achylia, but there are many conditions other than these where connective tissue is common, possibly due, as the former author says, to the meat having come from old, tough animals, without proper ripening. Since the connective tissue of well-cooked meat can be entirely dissolved by the digestive juices, particular care should be taken that the chopped meat in the test diet is eaten rare. Salted or smoked meat is much more difficult of digestion, and hence its connective tissue is much oftener found in the feces and has much less significance.

Meat Fibers.—Fragments made up of meat fibers are described as being so numerous that they can be detected by the naked eye, but it has never been the author's good fortune to see them in such abundance. Under the microscope, however, they are readily detected from their brilliant-yellow or reddish-brown coloring, dependent on the amount of hydrobilirubin in the stool, and their more or less distinct striations. Their pathologic significance is dependent on their number, an increase of which one soon learns to recognize by the fact that they are heaped up or grouped instead of being isolated, their square corners and maintenance of striations instead of rounded corners, and the absence of striae when digestion is vigorous. The nile blue sulphate slide, too, shows these muscle fibers stained a beautiful light-blue, much like a robin's egg (Fig. 31, a).

The significance of a large number of these muscle fibers is that duodenal digestion is impaired, due to defective secretion of pancreatic juice. Achylia gastrica alone can produce abundant connective tissue, but not muscle fibers in the stool of the test diet. If the pancreatic digestion alone is impaired, we have muscle fibers, but no connective tissue; if both are simultaneously impaired, because hydro-

chloric acid stimulates pancreatic juice secretion, we have both varieties of meat remnants present. The disturbance of pancreatic digestion does not necessarily mean impaired secretion, for often the increased motility of the small intestines carries the food forward before there is sufficient time for its complete digestion; then, again, insufficient absorption may also be the cause of the appearance of fibers in the feces. In both of the last instances trypsin will appear in the feces, or, after the oil meal, in the stomach, but, if the pancreatic juice is suppressed, in neither. While ordinarily, when large numbers of fibers are found in the feces, they contain no nuclei, still, when their number exceeds a certain limit, nuclei may be found. A. Schmidt has attempted to make this occurrence synchronous with the absolute suppression of the outer secretion of the pancreas, but many investigators have strongly opposed this view, and it evidently has not been fully proven.

Fat.—Fat is usually found in the stool of the test diet in three forms. First, when diarrhea is present, we have small yellowish-white, soft masses, which consist solely of fat. In diseases of the pancreas we often see stools which, when passed, consist almost entirely of fluid fat, but solidify, later on cooling, and then appear exactly like butter which has been melted and then allowed to cool. Much more common is the typical fatty stool of yellowish-white (clayey) color and pasty consistency, which is generally recognized. In this will be seen small fat clumps, but it is made up chiefly of fatty acid and soap crystals thoroughly mixed with other fecal matter.

Microscopic Examination.—The microscopic examination of the plain slide shows vast numbers of long delicate needles and shorter plumper ones, very often arranged in groups. These are fatty acid crystals and magnesium and calcium soap crystals, which, by warming with a drop of acetic acid and allowing to cool, may be changed to oil drops, but which can more readily be distinguished in the third slide stained with nile blue sulphate (Figs. 34 and 35). Here the neutral fat is colored red, the fatty acids a deep-blue, while the fats which are partially split into acids are violet. The soap crystals undergo no change of color, but the pretzel-shaped masses become colored a dark-gray blue. These masses of fatty acids and soap frequently assume some size, are often well stained with hydrobili-rubin, or even bilirubin when diarrhea is marked, and are often exaggerated by some who give patients large quantities of sweet oil and then pick out these masses from the stool, demonstrating them to the patients, and unfortunately sometimes to inexperienced physicians, as gallstones. It has been



Fig. 34. Microscopic appearance of oil in seeds stained with nile blue sulfate. *a*—neutral fat, *b*—bitter-soaps.

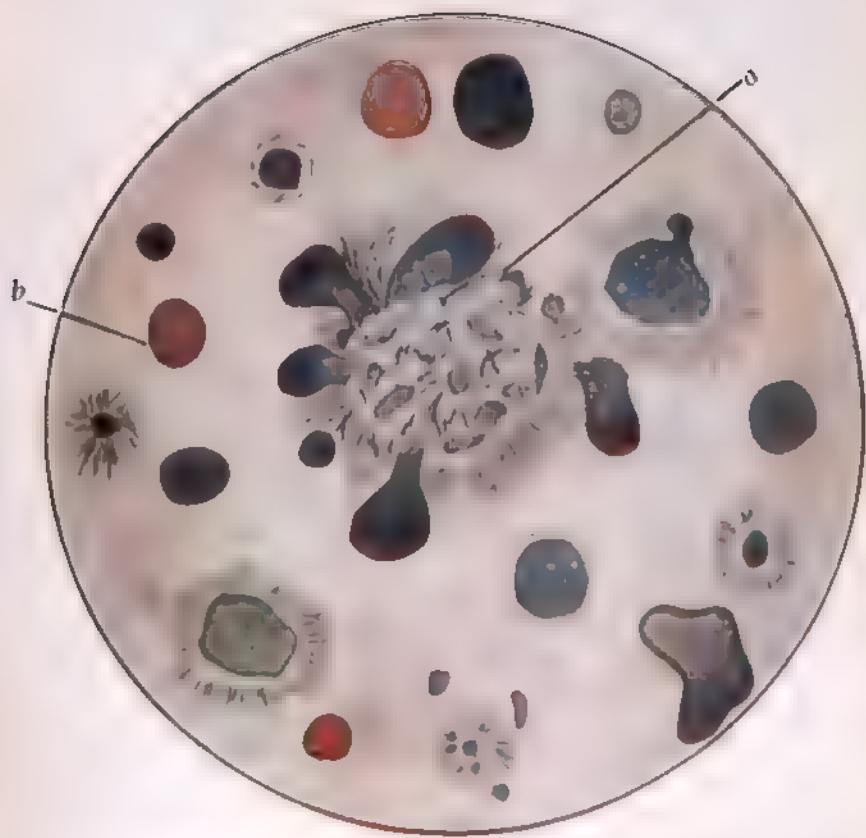


Fig. 18. Microscopic appearance of partially digested fat, stained with tolle blue sulphate
a, fatty acids; b, partially split fat (Ehrlich).

the author's experience to see these shown at medical meetings as a proof of the wonderful effect of olive oil in the solution and elimination of concrements of the gallbladder. The butter stool, so-called, of destructive pancreatic disease is found under the microscope to be made up of numerous oil drops and irregular masses of a grayish hue, which will be found stained red in the third slide. By gently warming the native slide without acid, all of these masses—unless, as sometimes happens, casein is present with fat adherent and in its meshes—will be found to have resolved themselves into groups of

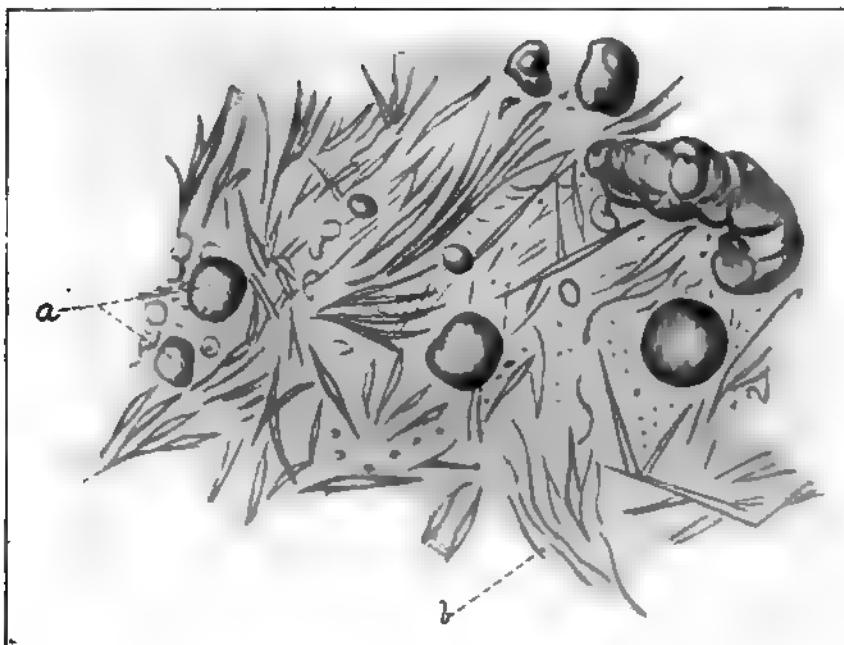


Fig. 36.—Microscopic appearance of unstained fatty stools, fatty acids in excess. *a*, fat globules, *b*, fatty acids. (A. Schmidt.)

fat globules. As a quantitative estimation of the several amounts of fatty acids, soaps, and neutral fats is impracticable in a clinic, we are compelled to form a judgment of the relative proportion of these different forms, much as a practiced eye can detect a leucocytosis by merely glancing at a smear of blood without being actually able to state the grade or extent. So, in examining a specimen of fees, if well mixed, we may say at once the fatty acids or soaps far exceed the neutral fats in amount, or vice versa. This excess of one over the other answers roughly the query whether pancreatic secretion is impaired (pre-

ponderance of neutral fat), or absorption is diminished by exclusion of bile from the intestinal tract, or *tabes mesenterica* (greater proportion of fatty acids and soaps). Unfortunately, as has been stated, the subsequent splitting of fat by bacteria in the lower bowel has robbed neutral fat predominance of its significance as a proof of exclusion of pancreatic juice, and Zoja has suggested that a lessened amount of soaps has the same clinical value, because the loss of alkali from the lessened secretion of the pancreas interferes very much with soap production. In cases of pancreatic disease the loss of fat, which appears in the stool, may be from 20 per cent to 80 per cent, dependent on the extent of the still remaining normal secreting structure, and only secondarily on the obstruction of its flow to the intestine. If pancreatic disease is combined with obstruction to the bile, the loss of fat is not greater than is the absence of bile alone. Intestinal dyspepsia and catarrh do not interfere to a very great extent with the absorption of fat, and the general opinion that with every intestinal indigestion or catarrh the absorption of the fat is the first to suffer is not substantiated. Much oftener, in the writer's experience, the protein, particularly in the form of meat, is first met in large quantities in the stool.

Carbohydrates.—Carbohydrates are never found in a normal stool from the test diet, but under pathologic conditions they appear in notable quantities. They arise almost always from the potato purée and only in very severe disturbances from the bread. Macroscopically, it is very rare that they are seen, and then usually because the purée was not sufficiently macerated, so that lumps were left in it. These appear in the stool as glassy, transparent, sago-like masses, formerly supposed to be fragments of mucus. In the writer's experience only by means of the microscope can the differentiation between fragments of potato starch and mucus be made, by which, particularly in the iodine slide, the large potato cells are found to contain a few blue starch granules. Much more common, when examined microscopically, are the isolated blue starch granules, which are distended, thereby losing their oval form and concentric lines. Another common form is the amethyst-colored remnants found attached to the cellulose. All of these can be distinguished only on the slide to which Lugol's solution has been added, because, due to partial digestion, they have no distinctive form. Chemical tests for carbohydrate in stool are awkward and of little value, but much can be learned as to their presence by the active fermentation noted in the jar when opened and the acid reaction, both of which can be further verified



Fig. 37. Fermentative stains containing potato cells and coagulase stained with Fungès solution. (A. Schmidt.)

by thinning somewhat the solution of the feces employed for microscopic examination and pouring it into an ordinary fermentation tube, which, if allowed to remain in a warm place (not necessarily a thermostat), for twenty-four hours, will show an excessive amount of gas in the longer arm of the tube and the reaction will be strongly acid if carbohydrates are abundant in the stool. On the contrary, it should be said that, if under the same conditions the reaction is alkaline, it indicates an excessive protein residue in the feces, either from food remnants or from pathologic excretion of mucus, pus, or blood. As sugar is never found in the stool, and cellulose ferments very slowly apart from the intestine, the fermentation of the feces may be taken without question as a proof of a large starch residue. The fermentation tube has always been used by the writer, as well as the more complicated instrument of Schmidt, and is much more cleanly to work with. In persons with a normal intestinal digestion on the test diet the starch disappears absolutely, but on a self-chosen diet starch granules often appear in the cellulose remnants. The most frequent cause of starch in the stool on the test diet is fermentative intestinal dyspepsia, which Schmidt has found to be due to the impaired digestion of cellulose. This form of dyspepsia or indigestion passes over into a form of intestinal catarrh, and then, of course, the loss of carbohydrate is much increased. Duodenal catarrh also may lead to marked loss of starch in the stool, but colon catarrh alone is always accompanied by a most excellent utilization of this form of food. Absence of fecal starch remnants will also be found with pancreatic disease and obstruction of the bile, while even with severe tubercular disease of the intestine or mesenteric glands, where the fat absorption suffers notably, it is astonishing to mark the almost complete absence of starch from the stool. Whenever carbohydrate remnants are found in the feces, it is customary to see large empty potato cells, while in the stool of the normal individual they are rare, and in the constipated are never found. Schmidt, from this circumstance, infers that diarrheas of certain kinds are dependent on a faulty digestion of cellulose, while constipation rests on a too vigorous digestion of the same material.

Decomposition Products of Food Material.—Decomposition products of food material have played a very prominent part in medicine since the habit of ascribing all obscure symptoms of a nervous nature to autointoxication. Of these, indol and skatol are the most important, but the detection of their increase is so complicated and beset with so many difficulties that, as a clinical method, it can never prevail, for, since these two substances are absorbed to a certain extent

and appear in the urine. rendered innocuous by union with sulphuric acid, we must quantitate both urine and feces to obtain the total amount. Then, again, it has been proven that decomposition in the intestine is not the sole source at least of indol, for in starvation and malnutrition it comes from active retrograde metamorphosis of the protein material of the body. Up to a certain extent, too, the body always possesses an antidote to this poison in both sulphuric and glycuronic acid, as shown by the author.¹ In only one condition has the author found an increased urine indican test of any value in diagnosis, and that is to aid in distinguishing an appendical tumor from an inflamed gallbladder. The former usually shows a strong indican reaction in the urine, and the latter a trace of bile. Another long-respected view that flatus in the intestines was due to increased fermentation must be given up, for we find that, where examination shows the most lively fermentative processes, as in some forms of intestinal dyspepsia, there is no increase of gas. Much oftener gas is due to faulty absorption, particularly where stasis from a leaking heart is beginning, or, more recently, it has been shown that carbon dioxide may be eliminated from overcharged blood into the intestine, a compensatory means of excretion from the lungs.

Digestive Fluids.—The digestive fluids leave very few remnants, with the exception of the stercobilin or hydrobilirubin, the means for whose detection has been mentioned on page 168. By the intensity of the red color we are able to draw some conclusion as to the amount of this pigment in the feces. Its antecedents, bilirubin (yellowish-brown), or an oxidized product of the same produced by calomel and sometimes by an oxidase of colon mucus, biliverdin (green), rarely appear in feces, and then only when peristalsis is very much hastened. If their presence is associated with catarrh of the small intestine, they are always accompanied by an abundance of food remnants—starch, meat fibers, etc. The alcoholic extract of the feces turns green when these pigments are present and the aldehyde reagent is added. As to ferments, there is not the slightest doubt that they appear in the stools increased when peristalsis is exaggerated, but, apart from trypsin, animal diastase (amylopsin), and erepsin, no practical use has ever been made of their detection for clinical purposes. The author's personal experience has been limited to trypsin, which, on account of the fact that the innumerable bacteria found in the intestine, and particularly the colon bacillus, have the power of splitting protein as the trypsin does, employing the feces for the detection of this ferment, by

¹ Salkowski's *Festschrift*, 53.

which we attempt to learn whether the pancreas is functionally active, is very unsatisfactory. It is much better to employ the gastric contents after an oil meal, which should be given in the manner here described, as employed by the author as a routine examination in the clinic when we wish to investigate the pancreatic functions. Wash out the fasting stomach and then give the patient a glass of good sweet oil, which he usually drinks readily, or it may be poured down the tube after washing the stomach; then the patient takes a teaspoonful of magnesium oxide, suspended in water to neutralize the hydrochloric acid, which with pepsin destroys the trypsin; in forty-five minutes the oil and duodenal contents are removed with the tube, the oil rises to the surface, and the digestive fluid can be removed by a pipette; the blue litmus paper should not be changed by it, or further use is impracticable; if neutral or alkaline, a small piece of boiled egg may be placed in some of it in a warm place, or the Gross test (page 154) may be employed with a solution of 0.5 gram casein in a liter of 0.1 per cent sodium bicarbonate solution and the use of 1 per cent acetic acid for a precipitant instead of sodium acetate solution. If no trypsin is present, all the tubes have a precipitate. In perfectly normal pancreatic digestion, trypsin has never been missed by the author in the contents withdrawn from the stomach after the oil meal.

Inorganic Detritus.—The inorganic detritus in stools—triple phosphate, calcium oxalate, and cholesterin crystals—have never offered the author the slightest aid in a clinical way. Charcot-Leyden crystals have been seen without the presence of parasites, whose association is commonly believed, and the hematoidin crystals, where the surgeon (Mumford) found a collapsed ribbon-like colon and made an anastomosis between the cecum and the sigmoid. Bismuth crystals and small fragments of charcoal, both intensely black, one is sure to come on and should be familiar with their appearance. Their elimination from the intestine is very slow, and they may be found days after their medicinal use has ceased. With real gallstones in the feces it has never been the author's good fortune to meet. "Intestinal gravel," as it is sometimes called, is not so rare, and, while the most of it springs from seeds and calcareous masses from the union of lime with fatty acids, some in the author's experience have shown evidence of former faceted surfaces, not unlike what has been seen by surgeons in the gallbladder, when, in spite of symptoms, no large stone was found. Whatever the reason for their disintegration may have been, they are clearly fragments of broken-down gallstones, and a small fragment picked up with the pipette from the débris left, after pour-

ing off the liquid portion of the feces, ground up with the end of a glass rod, extracted with a few drops of hot alcohol on a slide and the liquid transferred to another, will, on evaporation, show the characteristic crystals of cholesterin.

PATHOLOGIC PRODUCTS OF THE INTESTINAL MUCOUS MEMBRANE.

The most common of these products and that having the greatest diagnostic significance, is the mucus, which may be found in long shreds, or so finely divided that it looks like a scum floating on the surface of the liquefied feces. Ordinarily it is useless to examine with a microscope if no fragments can be clearly distinguished by the naked eye, but when it is finely divided by digestion, coming apparently from the small intestine, a spatula slipped under this scum will often remove enough to transfer to a slide, from which often a very good picture of the condition of the mucous membrane of the intestine can be obtained. The mucus usually appears as glassy, transparent, colorless shreds and masses, which either cling to the outside of a formed stool or are intimately mixed, and first become visible when the feces are macerated. Then, again, we have the ribbon and string-like forms, which may be brown or opaque from adherent fat, and epithelial cells, leather-like and in fragments, so long that patients often wash them out and bring them to the physician as fragments of tapeworm.

In general it may be said that the appearance of mucus in the stool indicates an inflammatory condition of some portion of the intestinal tract, though in itself it gives no hint as to the site or extent. The site of the catarrhal condition may, however, often be determined by attendant circumstances, all mucus that is visible to the naked eye comes from the colon, and all band- and tube-like forms and clumps clinging to the sides of the stool come from the sigmoid and rectum. When the mucus is intimately mixed with the feces, we may say that the higher portions of the tract are affected, and the more thorough the mixture the higher the section. The mucus from the small intestine is much less liable to be found in the feces, first, because that portion secretes mucus less readily than the colon, and, second, because the mucus is more likely to be digested. Hence the inference that mucus comes from the small intestine can be maintained only when the fragments are very minute, associated with food remnants, and, if stained with unchanged bilirubin and partially digested epithelial cells and their nuclei are present, the presumption is still greater. Mucus

from this portion of the intestine is usually poor in cells, but rich in bacteria, while in fact, if the inflammation is in the duodenum, no mucus at all may be present in the feces. We can never judge of the intensity of the inflammation by the amount of mucus. In mucous colitis, where the amount of mucus is very large and its discharge without fecal matter is often accompanied by pain, the rectoromanoscope has shown us little or no inflammation of the mucous membrane, and apparently the stimulation is at least partially controlled by nervous

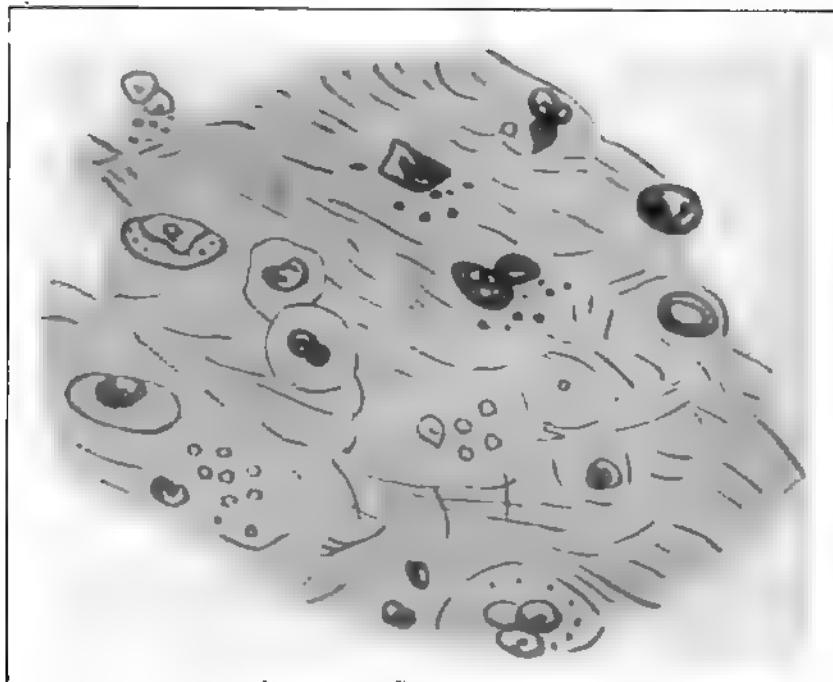


Fig. 38.—Microscopic appearance of mucus from small intestine, containing fatty acids and partially digested epithelial cells. (Schmidt and Strassburger.)

influences, and this is further proved by the transparency of the mucus and its poverty in epithelial cells. The opacity of the mucus, however, does not always bear a constant relation to the number of cells, because it may be produced by the imbibition of fat. When we find, by microscopic examination, numerous epithelial cells, especially with leucocytes, the inflammatory character of the lesion is assured; still, the superficial layer of the mucous membrane may lose enormous numbers of its cells without its having undergone serious pathologic changes. In catarrhs of the colon the epithelial cells and also the

leucocytes are often found shriveled, which, according to A. Schmidt, is due to a rigidity and contraction produced by the absorption of fatty soaps, which also cause a loss of the characteristic cell formation, but retention of the nuclei that are still susceptible of staining. In those minute fragments of mucus which are driven from the small intestine these distorted epithelial cells are rarely found. The cells are almost invariably of the cylinder variety, while the pavement cells,



Fig. 39. Microscopic appearance of colon mucus with "shriveled" cells (Schmidt und Strassburger.)

if present, are from the anus, or possibly nucleus free, hardened specimens from the mouth. The leucocytes are polymorphonuclear and contain all sorts of granulations. By the formation of vacuoles their size may be increased two to threefold, and they then resemble very closely the motionless amebæ.

Pus.—Pus appears in the feces as very numerous leucocytes attached to a fragment of mucus, which forms a slender means of union to the various corpuscles. Free or unattached pus is very seldom

seen, and, because of its admixture with the stool, is very difficult to distinguish either with the naked eye or with the microscope. In hundreds of examination of stools, only twice has pus been so abundant that one could say at a glance that it was present—one a suppurating dermoid cyst, as determined at autopsy, which had broken through

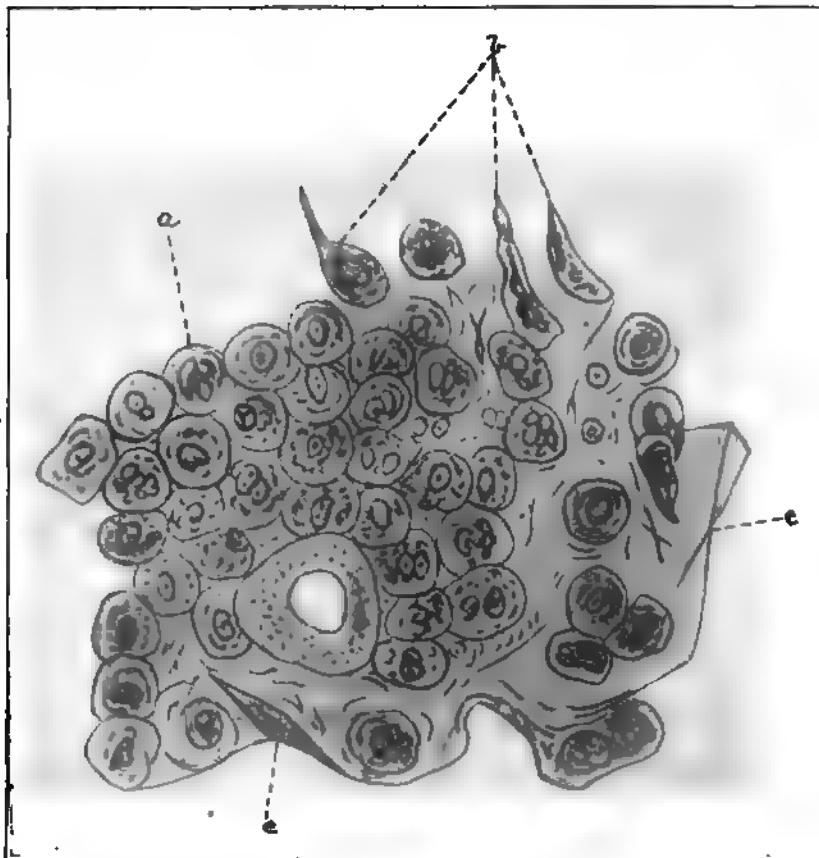


Fig. 40.—Microscopic appearance of pus flakes from feces in chronic diarrhea. *a*, leucocytes; *b*, epithelium; *c*, fatty acid needles; *d*, Charcot-Leyden crystals.

into the lower intestine, and the other an abscess associated with malignant disease of the sigmoid and stricture, where discharges of blood, pus, and mucus occurred without fecal matter. Hence, as A. Schmidt says, when a large amount of free pus is discovered in the stool, one must always think of the rupture of a paraintestinal abscess in the vicinity of the lower colon, for, if an appendical abscess ruptures

into the intestine, or there is an ulcer in the small intestine (typhoid or tuberculosis), the pus is wholly disintegrated before it reaches the outlet of the tract. On the contrary, mucous shreds studded with pus can spring only from the intestine, and such are found with dysentery, ulcer, active colitis, neoplasm, and syphilis. In the microscopic picture the pus corpuscles are often found in a state of fatty degeneration, just as they are in chronic pyelitis.

Tissue Fragments.—Tissue fragments in the stool are undoubtedly found from ulcerative colitis, invagination, polypus, and fragments of ulcerated neoplasms, but the liability of confusion with detached mucus and food remnants is so great that only imbedding, cutting, and careful histological examination under the microscope will enable one to make a positive statement.

Blood in the Feces.—Blood in the feces may present the normal bright-red color when alone or mixed with mucus and pus. It comes from polypi in the sigmoid or rectum, from hemorrhoids, or fissures of the anus. When, however, it remains a long time in the intestinal canal, whether it comes from the sigmoid or higher up in the canal, it gives a brownish hue to the stool and, if abundant, black, as previously described (page 171). Therefore, in spite of former views on the subject, apart from hemorrhage at the anus, the degree of decomposition (change from hemoglobin, red, to hematin, brown) of the blood gives us but little information as to the site of the bleeding. Attendant circumstances, however, often shed much light on the cause of the hemorrhage. If, for instance, the blood is mixed with pus, we may assure ourselves that it comes from an ulceration in the intestinal tract. When the blood is mixed with mucus, it denotes severe catarrhs, usually of the colon, polypus, or invagination. Low-lying malignant tumors also produce this combination, and, in addition, venous stasis may cause bleeding from the intestinal canal. When the blood is red (hemoglobin), the corpuscles can usually be distinguished by the microscope, but when they are brown (hematin) they cannot, and we are obliged to have recourse to a chemical test. When the hemorrhage is minute ("occult"), it imparts no characteristic color to the feces, and, still, the latter promptly gives the reaction for "occult," or, as R. Schmidt chooses to call it, "chemical" blood. Before the positive outcome of the test can be made absolute, the patient should have had a laxative (castor oil) and then have refrained three days from meat, fish, soup, beef tea, or anything which may by any means have been brought in contact with blood.

The test (based on Weber's discovery) is performed most readily

by pouring 2 c.c. of glacial acetic acid into a wide-mouthed test tube, and with a glass rod removing a piece of feces, if solid, as large as a hazelnut from the jar, and mixing it thoroughly with the acid; then the solution should be cooked to destroy any leucocyte or mucous oxidase, taking care that it does not spurt and burn the operator, for it boils at a very low temperature; after cooling, an equal amount of ether or alcohol is added, and the whole shaken or stirred until a thorough mixing is produced. Then three test tubes are filled with 2 c.c. of alcohol each; to the first a granule of solid gum guaiac (not the powder, which is often bluish-green in color) is added, which is thoroughly dissolved with the aid of a glass rod, and a few drops of the solution or tincture poured into test tube No. 2, from which also a few drops are poured into No. 3, so that we have guaiac in three dilutions; then to each an equal amount of good, fresh hydrogen peroxide is added and thoroughly shaken. Now, to each of these tubes in turn, beginning with the strongest tincture, a few drops of the alcoholic or ethereal solution of acid hematin, into which the digested blood is converted by glacial acetic acid (if blood is present), are added; the alcoholic extract may be filtered, and, if the ethereal does not separate readily, a few drops of alcohol may be added. When blood is present in the stool, each drop of the glacial acetic-alcoholic extract, as soon as it strikes the mixture in one or all of the tubes, will turn greenish-blue to distinct blue. The intensity of the reaction will vary in the three tubes in correspondence with the amount of blood. Schroeder has demonstrated that large amounts of blood demand large quantities of guaiac, and, furthermore, that a minute quantity of blood may utterly fail to give the reaction when added to a concentrated solution of guaiac. Much in the same way benzidine, aloin, and paraphenylendiamine are employed, but they possess no advantage over guaiac for clinical purposes where undue fineness is not demanded, and a reagent like benzidine, which would show the slightest hemorrhage from the gums or pharynx if swallowed, is a hindrance rather than an aid when one wishes most particularly to learn whether ulcer which, if it bleeds at all, produces an appreciable amount of blood, is present. When all these precautions are carried out—determination of absence of sources of bleeding in the gums, nose, and pharynx, a thorough clearing out of the intestinal tract, followed by three days' meat free diet, and freedom of the anus from hemorrhage (fissure or hemorrhoids)—a positive test for chemical blood can be utilized as perhaps the most diagnostic point in favor of interruption of continuity of the mucous membrane of the tract, as ulcer, cancer, or rupture of small varicosities.

Bacteria.—The bacteria in feces offer but little aid to diagnosis in the unstained specimen, for they all "look alike" to the observer. When, however, on an iodine slide (as we will call it) the particle of feces is well rubbed with Lugol's solution, by the differential staining produced much can be learned in regard to the objects affected. The microbes which stain blue with iodine consist, first, of the rod-like bodies—oval, lemon-like, or spindle-shaped structures—which might resemble starch granules except for the smaller size of the former, or yeast spores except that the latter are always stained yellowish-brown, thin leptostrix-like threads, and cocci. The thick rods and spindle-shaped forms often have one pole unstained or with cross lines, so that they appear as if containing spores. They have received various names—among others, *Clostridium butyricum*—but all are agreed that they have the power, apart from oxygen (anaerobic), to split carbohydrates to butyric acid; apparently, too, the yeast-like bodies belong to this group. The leptostrix-like threads and the cocci, which are sometimes more violet after iodine, have not been identified. The failure of the Boas-Oppler bacilli to stain as contrasted with the leptostrix, which closely resembles them, should be carefully noted. The granulose-containing organisms—i.e., those that stain blue—are never found in a normal stool on test diet, so that their presence in any number always indicates a faulty carbohydrate utilization, which is verified by the numerous starch granules under the microscope and the results of the fermentation of the stool.

Protozoa of the Feces.—The only protozoa of the feces having any clinical significance are the *amebæ coli*—one, the *entameba coli*, which is harmless, and the other, *entameba histolytica*, the cause of tropical dysentery, which causes ulcerations of the lower colon and abscesses of the liver. The latter was fairly common in our invalidated soldiers from the Philippines soon after the Spanish-American war, before the Army Medical Department had a chance to clean up in those possessions. The *entameba coli* may be found in healthy individuals, and yet are found often in patients who suffer from colon catarrh; whether the cause of it or a result of favorable conditions for growth has never been determined. They, of course, soon lose their motility when the stool cools and are found embedded in the mucus. When cool, they not only lose motion, but become encysted and invisible, so that the microscope should also be warmed before the slide is examined. In the *entameba coli* the nucleus appears very distinct.

Intestinal Parasites.—Intestinal parasites are commonly found among the lower classes of people, especially in the free clinics, though



Fig. 41.—Microscopic appearance of various abnormal food bacteria: *a*—clathria containing granules; *b*—yeast stains; *c*—starch granules; *d*—sarcina; *e*—lepto-like threads; *f*—bacilli containing granules; *g*—cocci containing granules; *h*—Bary-Dodder lactic acid bacteria stained with Laged's solution. (A. Schmidt.)

those in better circumstances may also possess them, particularly when rare chopped meat was included in the diet of undeveloped children. Suspicion should be aroused as to their presence by numerous eosinophiles in the blood or Charcot-Leyden crystals in the stool. The conclusive proof, however, is in finding the eggs or fragments of the worms, which must be differentiated from masses of mucus or food fragments, an undertaking not difficult with the low power of a micro-

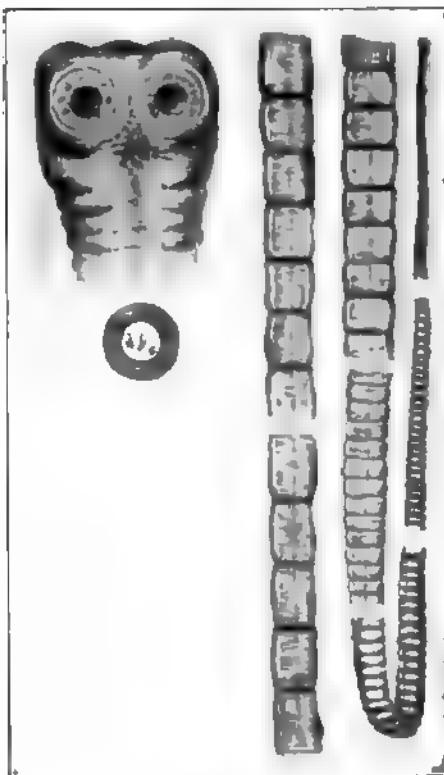


Fig. 42.—*Tenia saginata*, showing egg of same enlarged four hundred times.

scope. Only the more common forms will be mentioned here, as a complete list, with description, would fill a volume. The group one most frequently meets is the tapeworms, whose possessor is said, jointly with an editor, to be able to use the editorial "we." Each individual member of the group consists of a small head with a sucking apparatus, a very short neck, and a long chain of segments, or proglottids, which increase by forming new ones from the old; the oldest segments are

those farthest from the head and are suitable for reproduction, producing vast numbers of eggs. From time to time the riper segments are detached and are found in the feces. Most of these parasites spring from embryos in the meat of the animal in whose stomach the eggs from the feces of the original host have developed. The life his-



Fig. 43.—Segment of *Tenia saginata* enlarged twelve times

tory is unimportant, except that it points out the way of prevention—thorough cooking of all meat.

Tenia saginata, or beef tapeworm, is perhaps the most common and reaches a length of 4-8 m. (12-24 feet). The head is $2\frac{1}{2}$ mm. wide and has four suction apparatuses. The neck is only a few millimeters long; hence the segmentation begins much sooner, and each

segment has a lateral uterine canal and a uterus made up of seventeen to thirty fine branches opening into it. These segments pass through the anus of the host without the passage of feces, making autonomic movements. The eggs are round or oval, with the shell marked by lines arranged radially, and the embryo has six hooks. Man acquires this parasite from both the flesh of the ox and the goat. When fragments of such a worm are found and one is in doubt as to its character,

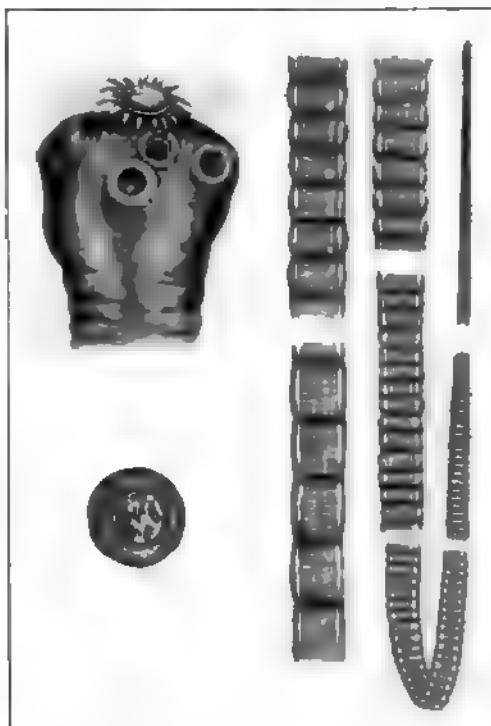


Fig. 44.—*Tenia solium*, showing egg of same enlarged four hundred times.

or when the patient states that such fragments have been passed, particularly in ambulatory practice, it is often most conducive to haste in diagnosis to wash out the colon of the patient with a rectal tube, when often these segments may be found, white and free from fecal matter. Placed between two microscopic slides, pressed rather firmly together, and then examined with the naked eye or with a reading glass, the lateral uterine opening can be distinguished and the network of genital canals, which by their greater number distinguishes this from

the *tenia solium*. The head requires a greater magnification for clear discernment, but the power should always be low.

Tenia Solium.—*Tenia solium* is fortunately much less common, since meat inspection has been more rigid under the control of the



Fig. 45.—Segment of *Tenia solium* enlarged twelve times.

government. Still, we hear of outbreaks among our foreign population on account of their fondness for uncooked ham and sausage, but that not every one who insists on the thorough cooking of meat is free from it is evidenced by the death of a veterinary and official inspector

of meats in Westphalia from trichinosis, acquired from pork killed within his own jurisdiction and presumably which he himself had inspected. This variety, which attains a length of only 2-3 m. (6-9 feet), is derived wholly from eating pork. Its head is not larger than that of a pin and has four sucking appliances, and a rostellum armed with hooks in the middle of the head. The neck has a length of only 1 cm. and is very small. The segments have also a lateral genital opening, like the *saginata*, but fewer (7-10), much larger, and to the naked eye a coarser network of canals connected with it. They are usually discharged in long ribbons and with the stool, while the eggs look much like the beefworm. These are the only varieties of the tapeworm that are at all common in our country; the others, *botriocephalus latus*, derived from fish, and *tenia nana*, are curiosities.

Round Worms.—The round worms have as chief representatives of their kind, and the one most commonly met, the *Ascaris lumbricoides*, whose habitat is the duodenum, but which migrates to the stomach, and by vomiting reaches the esophagus and often the nose. This is the worm of which the mother has the greatest fear, and to which she ascribes every attack of indigestion which the child may have. The eggs are freely discharged in the feces, are oval and inclosed in a transparent shell, surrounded by a layer of albumin; this outer layer is often stained brown from feces. There are two sexes, the male reaching a length of 15-20 cm., and the female 25-40 cm. Fairly good specimens were once found by the author in the stomach of a young man, a suicide from cyanide, at the autopsy, and his friends derived great comfort from the thought that their (the worms) presence had contributed to the depression which led to this rash act.

Oxyuris Vermicularis.—The *oxyuris vermicularis*, or pinworm, is thread-like, and the male has a length of 3-5 mm. and the female 10-12 mm. Its habitat is the upper portion of the colon, but it wanders to the anus, and in young girls to the vagina, there producing an intense itching, and in female children often a leucorrhea. The eggs are not found in the stool itself, but can be readily obtained by wiping the skin around the anus with a wad of cotton. The eggs are of irregular shape, like a bean, and have a thin envelope. They are occasionally found in the appendix, but are not always to be regarded as the cause of appendicitis.

Ankylostoma Duodenale.—*Ankylostoma duodenale*, a variety of which is known to us as the "hookworm" or *necator Americanus*, has come to have a much greater significance for us since a knowledge of its prevalence through the South has been brought to us by the

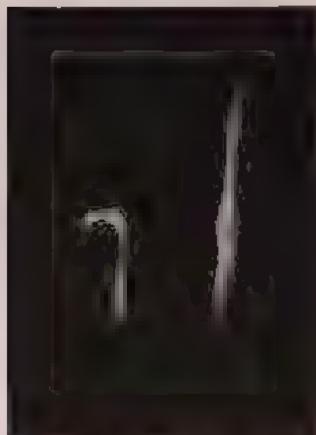


Fig. 46. Pinworm (*Oxyuris vermicularis*) natural size.

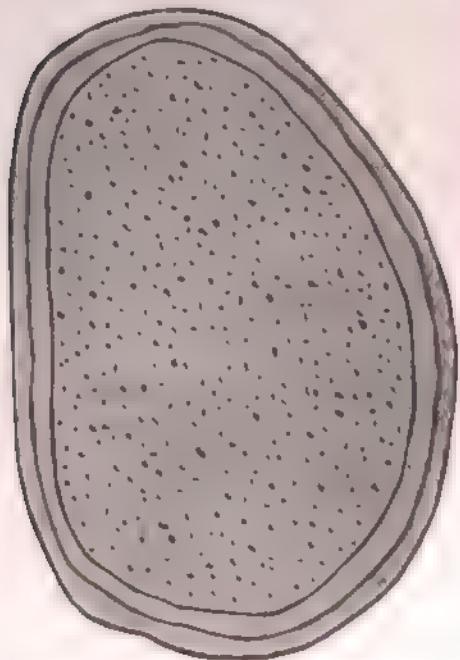


Fig. 47. Egg of pinworm enlarged twelve hundred times.



Fig. 48.—Hookworm (*Ancylostoma duodenale*), natural size.

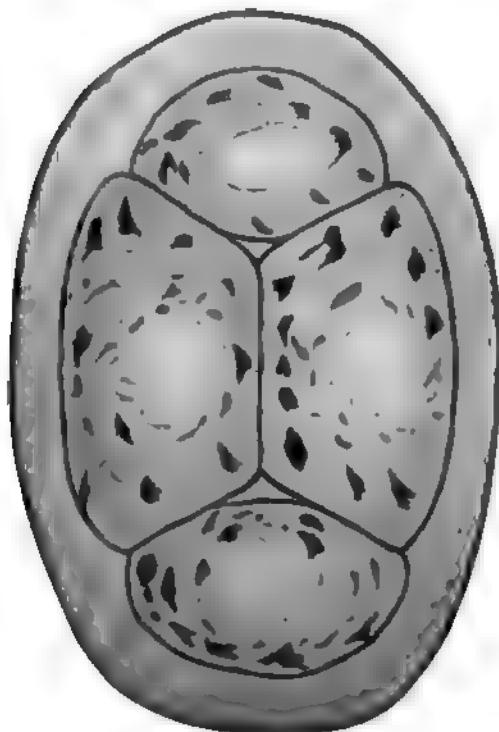


Fig. 49.—Egg of hookworm, showing segmentation, enlarged twelve hundred times.

labors of Allen J. Smith and Charles W. Stiles. The worm fastens itself with its sharp hooks to the mucous membrane of the small intestine, and not solely to the duodenum, as its name would indicate, and by sucking the blood, at the same time injecting a poison of its own secretion, produces true anemia. The eggs are oval, have a hard shell, and contain an embryonic cell, which has undergone partial segmentation. They are eliminated in enormous numbers with the stool, which, when kept warm, allows them to develop into larvae. The infection occurs through the mouth or through the skin. According to Stiles the chief cause of infection in the South is the carelessness in the disposal of the stools, with which the soil becomes impregnated, and the barefooted natives easily acquire them through the skin.

Trichinosis Spiralis.—The *trichinosis spiralis*, though occasionally found in the stool, is so rare that it has no clinical significance as a constituent of the feces.

CHAPTER VII

DIETETICS IN DIGESTIVE DISORDERS

General dietetic principles have been evolved from observations made on the time during which various foods remain in the stomach, on their state of digestion when withdrawn at certain intervals, and their utilization as determined by the residue in the feces. For instance, by the first method we know that fat meat leaves the stomach much more slowly than lean or than meat cooked in fat, as 250 grams of boiled lean beef leave the stomach in three to four hours, but the same amount of roast goose demands four to five hours; by the second method we learn that beefsteak is dissolved in three hours, while pork requires four hours; and by the last method we learn that the cellulose of vegetables and the connective tissue (tendons, arteries, etc.) of meat are the most difficult to convert into an absorbable product. Particular forms of diet may be used for diagnosis, as in the test diet for intestinal functions; or the use of nuts, coarse grains, and the cabbage group, as recommended by Kelling, for exaggerating the symptoms in stenosis of the intestine, and by others to procure a mild hemorrhage in chronic ulcer of the stomach and the duodenum; or for therapeutic purposes, as in the restriction of the patient from excessive use of meat in gastric hypersecretion; or the insistence on finely divided, if not liquid food, in pyloric stenosis. Above all things, we must insist on quantity, for these patients with digestive disorders are undernourished from fear of food, or because it causes discomfort, much oftener than from any inability of the digestive organs to dispose of it. So far we have been between the two types or schools of dietetitians, one of which, following Abernethy's old dictum to an overanxious patient, "Eat the shovel and tongs, madam, but do not bother me," has always advised loosely, milk, gruel, and beef tea, and in one case which was seen in consultation, a tubercular enteritis, wasted to the last degree of emaciation, the physician in charge told the author that the sufferer was getting plenty of nourishment because he was partaking of popcorn water freely; and the other school, which would have a patient equipped at table with knife, fork, plate, cup, and a pair of scales, with which every morsel should be carefully

weighed, with due reference to calories, protein, carbohydrates, and fat. Such an effort for scientific accuracy will probably be confined to hospital wards, and, while the profession is vastly benefited by the results obtained in such magnificent equipments as that of the von Noorden clinic at Vienna, we shall have to pursue some middle course, more adapted to the facilities of our patients; indeed, such a one has been devised from the excellent tables of Atwater, who has analyzed the foods as prepared for the table, and Arnold, who has adopted the old measures which have served us for centuries in administering medicines—the teaspoon, the tablespoon, and wine glass, a piece the size of a pea, etc. Granted that it is not accurate in this time and age, we are beginning to appreciate "near silk" when we cannot have the real article. These suggestions in regard to the diet in various disorders take into consideration what is of benefit to the patient—not what he thinks is of benefit—and will often have to be modified to meet idiosyncrasies as to food. One says, "Milk makes me constipated"; another, "Eggs make me bilious"; while a third declares that cream produces a "sour stomach." In such cases all arguments fail, and one will simply have to exclude them from the diet prescribed and substitute an equivalent in calorie value.

PROPHYLAXIS.

Prophylaxis in modern times is becoming more and more the function of the practitioner, as well as that of the public health officer, and, while such a work as this should be devoted to the treatment of digestive disorders, a few words can be well devoted to prevention. It has been found that the breast-fed infant usually prospers far beyond his unfortunate artificially-fed companion, but, even after solid food begins to be taken, the former still has the advantage in freedom from digestive disturbances. Still, young children are simply a species of young animal, and, unless closely watched, devour their food as their prototypes do, with disastrous results. Many a patient says, "I have had stomach trouble all my life, even as a child I suffered," and, apart from congenital enteroptoses, one can usually assure himself that such a one belonged to the numerous band of "bolters" almost from birth. During childhood the abused and insulted digestive organs submit for a period to the indignity of "bolted" food, and then comes the storm in the form of a so-called "bilious attack": three days of vomiting and inability to take food, attributed always to the last article of food taken before the revolution, recovery, and another on-

slaught on the patience and indulgence of the stomach. No parent should neglect the teeth of his child, insisting on the use of a tooth-brush, and consulting a dentist or a dental clinic when the child complains of toothache, which often means decayed teeth. The admirable attention paid to the teeth of pupils in our city schools by the school dentists could well be imitated by the rural schools rather than some of the frills of education which the latter ape. Furthermore, uncleanly teeth, covered with decomposing food fragments, cause fetor of the breath, which is often perceptible to the patient, diminishing the appetite, and producing objectively many of the peculiar tastes—sour, bitter, etc.—of which patients complain, as well as providing a host of organisms which make their way into the stomach when food is swallowed. A coated tongue may also interfere with the delicate sense of taste which has been proven so essential for a free flow of gastric juice, and many patients declare that brushing the tongue, also with the aid of some antiseptic mouth-wash, improves taste and appetite. The importance of slow eating and good mastication has already been emphasized, but the best means to accomplish this is usually left to the patient. Many a one has devised such methods as laying down the knife and fork after each mouthful, placing the watch beside the plate and seeing to it that twenty minutes at least are employed in the act of eating, or reading a book or paper at meals, to accomplish this purpose. Cheerful companionship and lively conversation at mealtime, it is true, improves digestion by stimulating the flow of digestive juices, but, in the course of lively conversation, eating unfortunately only too often keeps pace with the rapid flow of thought, so that many of our public men are victims of the numerous state dinners thrust upon them. Not only does good mastication produce copious saliva, but a free flow of this has also been proven to cause a more abundant secretion of gastric juice. Condiments also are known to stimulate the flow of the former and probably also the latter; hence care should be taken in their use whenever hypersecretion is present. The avoidance of eating when excessively weary, angry, sad, or frightened explains itself, for, curiously enough, food taken in such a state of mind may produce epigastric distress and sometimes vomiting. This may be due to loss of appetite at such a time, a factor, as Pawlow has shown us, of great importance in aiding digestion. That one should eat at regular intervals has been taught for ages, and it is as true today as ever; every one has experienced the sensation of "out-staying the appetite," and the indifference with which food is taken when the customary meal time is deferred, and the subjectively, at

least, sluggish digestion which follows. We can all agree with the refrain of the popular song, "I eat when I am hungry," but this does not excuse the impotence of refraining utterly from food when appetite is not present. There is some question as to when the heavy meal of the day is to be taken. The German sticks to the middle of the day, but anyone who has attempted to enter a German's place of business between 1 and 3 o'clock in the afternoon will find that there is a justification for this hour in the two hours taken from business for its digestion. With us the evening proves the better hour, for the business cares are over for the day and digestion can take place in peace and quietude. The employment of the five-meal schedule daily has served the author very satisfactorily where the patient was undernourished, and where impaired motility compelled small meals which the stomach could readily dispose of and pass on to the intestine, while three meals, copious enough to keep the nutrition at par, were very much delayed in their departure from the organ, causing distress and often pain, which was promptly allayed by the lesser meal. Corsets, by their compression of the liver, and secondarily of the stomach, particularly at mealtime and during digestion, impair very decidedly the motility of a weakened stomach. As long as fashion decrees they shall be worn, we should at least recommend their loosening or removal at mealtime. Another injurious feature of our habits is the extreme heat of many articles of food. For instance, soup, which is often taken at a temperature to which we would hesitate to subject our hands, will soon cause a mild gastric catarrh. The temperature of no food should be above that of the body—98.8° F. Then, again, there is a vicious habit of drinking ice-water before a meal, which a waiter always provides before he does food. It has been proven that it takes half an hour after a glass of ice-water to restore the temperature of the stomach to the optimum for active digestion. Persistent drinking of ice-cold sodas on an empty stomach will also ruin a weak digestion. Drinking at mealtime should be avoided, not because it dilutes the gastric juice, as was formerly supposed, for we know that fluids course along the lesser curvature and promptly leave the stomach, but because it aids hasty eating and imperfect mastication, since water or other beverage is made to take the place of saliva in aiding deglutition. Many have tried to determine whether it is better to eat and rest or eat and run, and at present opinion is divided. If we may follow the custom of animals, which seem to enjoy an excellent digestion, we will take our "forty winks" after a hearty meal, for "tired nature's sweet restorer" certainly

presses on us with insistent force at such a time, and dowagers rarely refrain even after state dinners. Wegele recommends that those patients—chiefly nervous dyspeptics—who awaken from a nap after a meal with a spinning head or even a headache, great lassitude, and a bad taste in the mouth, should take a short walk after eating and then lie down. With patients suffering from impaired gastric motility there can be no question of the advantage gained by lying on the right side for thirty minutes after a meal; whether asleep or not makes but little difference. Sufferers from gastric ulcer, however, often claim to suffer more pain when lying on the right side than when on the left, or sitting up. It has been the author's experience that much may be gained by inducing the patient, if possible, to rest or sleep a short time *before* the meal, particularly when weary. Sleep is fully as essential as diet in digestive disorders, particularly those associated with loss of flesh, for during sleep metabolism is very much delayed; in fact, insomnia is one of the most distressing symptoms of the disorder known as gastric neurosis. Excessive use of tobacco lessens the appetite and apparently produces gastric hypersecretion; hence smoking should never be allowed on an empty stomach, but after the meals smoking seems to aid digestion, or else our grandmothers were mistaken, many of whom, when old, smoked an after-dinner pipe and claimed that it overcame the discomforts of digestion arising from senile dyspepsia. It is generally accepted that during menstruation the digestion is retarded; hence at this time no gastronomic feats should be undertaken, and recurrence of partially cured gastric disorders should not discourage either physician or patient. Constipation should never be neglected, for patients are numerous who never have digestive discomfort except when two or three days elapse without stool.

CHARACTER OF FOODS.

The character and composition of foods for dietetic purposes must be studied along three lines—ease of digestion, readiness of departure from the stomach, and nutritive content. For instance, the old-time beef tea and many commercial food preparations fulfilled the former conditions, but not the last; cream the last, but not the former. As to whether any particular kind of food causes more or less painful sensation, apart from the form (coarse or fully divided) in which it is taken, is difficult to say. Subjectively, which is the only way to settle this point, and for which we have to rely on the patient, sufferers from cancer and achylia declare that meat causes more distress,

while those suffering from impaired motility declare that fats cause them most discomfort. Our views hitherto in regard to the digestibility of food have been acquired and confined almost wholly to its digestion in the stomach, but from study of the fluid containing casein and meat fragments, passing from a duodenal fistula we have learned that vastly more digestion takes place in the intestine than is supposed.

LIQUID NOURISHMENT.

Liquid nourishment is usually chosen where the digestive functions are weakened, and the simplest of this group is water, reinforced by some ingredient having actual nutrient value, like egg albumin, milk sugar, or many of the dextrine and peptone preparations on the market, like laibose, liquid malt, etc. These preparations serve a need, but, unless the miracle of the loaves and fishes is to be repeated, as is claimed by some of the manufacturers, semistarvation will always accompany their exclusive use, for their caloric value is so low, when diluted as recommended, that quarts must be swallowed to obtain 2,000-3,000 calories daily. While water is supposed to promptly leave the normal stomach, there is considerable doubt expressed as to whether this is true of the atonic stomach, which, as can be shown by percussion in an erect position, sags badly after a couple of glasses of water, so that such persons should be warned against any excess of water drinking or other fluid at any one period. As a rule, one glass at a time is all that should be taken.

Carbonated waters incite peristalsis, and undoubtedly have a mildly anesthetic effect on a hypersensitive stomach. When mixed with the syrups, egg, etc., at our soda fountains, if not too cold, the mixture makes an admirable adjuvant to our three-meal schedule when the patient is undernourished. Of course absolute purity of materials (including the calcium carbonate and sulphuric acid) must be insisted on, and, if such guarantee is not furnished, soda-water had best be avoided. The custom of overcharging natural soda-waters should be reprehended, for White Rock has been so heavily charged that it really caused unpleasant sensations and harmful effects in gastric disturbances, and it is the author's belief that it might cause rupture of a vessel if its coats were impaired. To avoid any danger of this sort, all that is necessary is, of course, to allow some of the gas to escape before drinking.

Milk, considered theoretically, should be the ideal food, since it contains fat, carbohydrate, and protein in proper proportions to meet the

wants of the body. On account, however, of its low nutritive content (approximately 12 per cent), it requires at least 3 liters daily to supply the needs of the ordinary individual, of which over $2\frac{1}{2}$ liters are water; hence, on account of its volume, it puts too great a burden on a weakened stomach. With impaired motility, any physician who prescribes a diet of 3 to 4 liters of milk daily should first take it himself for a short time. For the adult, too, there is great diminution in utilization, as 10 per cent of the nutritive material appears in the stools. Then, we have the unavoidable changes in the individual variations in the fineness of coagulation of the milk taken. Many times after a meal of milk such huge masses of curd are found that the lumen of a 12-mm. tube may be stopped. This difficulty may be overcome by taking it in teaspoonful amounts, or by adding to milk, soda, or lime-water, any of the commercial foods recommended for this purpose, or merely well-toasted bread as croutons ground up in a coffee mill and added in the proportion of a teaspoonful to a glass of milk. To overcome the disadvantage of volume, one can use thin (20 per cent) cream, one tablespoonful of which gives the same caloric value as a glass of the whole milk. On the whole, however, an exclusive milk diet with most individuals is a species of undernourishment—as a facetious young patient of the author's calls it, a "thin as a pin" cure. It may do fairly well for patients in bed, but, as soon as active life begins again, there is a nitrogen loss and muscular weakness, which is largely dependent on the fact that the weakened digestive organs are restricted in their absorptive power for milk, and the volume or residue in the feces increases as the amount of milk taken becomes greater beyond a certain limit; hence we confine the use of the exclusive milk diet to acute inflammatory diseases of the tract on patients confined to the bed. One thing is certain, that a not too extended employment of exclusive milk diet will check putrefactive processes in the intestine—whether due to the sugar of milk or the casein, we do not know—and relieve the patient of many of his neuralgic symptoms, but whether arising from the putrefaction is uncertain. Of course there is milk and milk. When patients assure you that they cannot take milk, always make inquiry with reference to the source of the milk. Many an individual will on a succeeding day take a certified milk with comfort when on a preceding day an inferior milk was rejected by the stomach. Milk is best for invalids when lightly cooked, or "soft boiled," as we say of an egg that is cooked three minutes. This destroys any organisms which may be present and makes it more digestible, so the best authorities state. Practically all the milk we now

receive is "pasteurized," which does not seem to interfere with its digestibility, while the former method of "sterilization" did most emphatically convert the protein into a modification difficult of digestion. We can readily increase the nutritive value of milk by adding to it sugar of milk (a tablespoonful to a glass), milk powder made by evaporation and grinding up the residue, or even condensed milk can be added with profit to whole milk. All these remarks as to the disadvantages of the milk diet apply to it when milk is employed exclusively; when used as an adjuvant to a mixed diet, that, as Kipling says, is "another story." One of the author's most valuable aids in all diets is the midforenoon, midafternoon, and bedtime glass of milk, and never under such conditions have the stools revealed any significant milk residue. The attractive way in which such a glass of milk can be put up at the soda fountains has been mentioned, but those who have a distaste for milk can readily add to it a little coffee, tea, powdered chocolate, or some good vanilla extract, which makes it more palatable. Furthermore, it is rare that anyone can be found, no matter how great his distaste, who will not take his portion of milk in the form of ice cream.

Condensed milk for any other purpose than above mentioned is unsuitable for most impaired digestions on account of the readiness with which it will ferment because of the added sugar.

A preserved or canned milk without the addition of sugar, prepared by the Borden firm, is on the market, and extremely palatable. On a twenty-one day trip from Galveston to Bremen the steamer carried only this milk, and there were no complaints.

Buttermilk contains less fat and milk sugar than whole milk, but contains 0.4 per cent lactic acid. A glass of this contains only 80 calories, while one of whole milk contains 160. On the contrary, however, buttermilk is much more digestible, and has been recommended by various authorities for fever and gastric ulcer, and it is the author's preference for feeding those jaundiced. It certainly stimulates intestinal peristalsis, and, according to Metschnikoff, by inhibiting putrefactive changes in the colon prevents arteriosclerosis, so that the catch phrase of one of our large milk contractors, found over its stores and wagons, is, "Drink buttermilk and live forever." When one does not live where buttermilk can be easily procured, small separators are made for household purposes to remove the fat, or the old method of standing milk until the cream separates may be employed. Indiscriminate souring is not so advantageous as the use of the Bulgarian bacillus, which makes the so-called "joghourt" and indiscriminate

fermentation introduces various kinds of organic acids in addition to the lactic. It must be observed that two purposes are served by the use of buttermilk—the introduction of lactic acid and the elimination of fat from the diet. When, however, whole milk is simply diluted and fermented, as recommended by the manufacturers of some lactic acid tablets, the former purpose is satisfied, but not the latter.

Sour milk, for reasons stated above, is not as good as buttermilk. Still, when first coagulated and beaten to break up the curds, it is not only an easily digested mixture, but much enjoyed by many people. When, however, the fat is retained, it is much less likely to be well borne.

Whey can have but little claim as a food on account of its minimum caloric value, but from its milk sugar content it forms an excellent beverage. The author's preference, however, is to provide patients with milk sugar and let them make a substitute by adding a dessertspoonful (approximately 10 grams) to a glass of water (approximately 240 c.c.), which makes it a little less concentrated than the natural product (4.1 per cent instead of 4.81 per cent).

Koumiss and *kefir*, the former of which made from cow's milk can be obtained at many drug stores, are allied to buttermilk, but not the same. Both of these are alike in having the greater part of their lactose converted to carbon dioxide, alcohol, and lactic acid. The casein also is converted by this process of fermentation into peptone-like bodies. This koumiss tastes distinctly sour, is an intoxicant in large quantities, and acts as an excellent diuretic. When fermented only one day, this preparation is a laxative; when two days, is indifferent; and when three days, is slightly constipating. Koumiss and kefir are said to be contraindicated when there is a tendency to apoplexy, gastric ulcer, and pulmonary hemorrhage. With these restrictions, no better food could be devised, since the carbon dioxide acts as a mild anesthetic and stimulator of gastric motility; the lactic acid checks intestinal putrefaction, the casein is converted into a material much resembling the protein of breast milk, and the small amount of alcohol stimulates digestion. Fortunately for our patients, koumiss from cow's milk can be procured from many of the large milk dealers and is delivered daily, but, as the name was first applied to mare's milk, it is a question for the United States Agricultural Bureau to determine whether it is misbranded.

Tea and *coffee* belong to the group of condiments, and have no nutritive value except when taken with cream and sugar. It is always easy

coffee, for instance, when digestion will allow them, to take with each meal, a cup of coffee, a tablespoonful of cream and at least a teaspoonful of sugar. By this, each cup attains a caloric value of 63, an amount not to be disregarded in undernourished patients. Dyspeptics, however, often complain of disagreeable sensations after a cup of coffee, and this causes a misconception with the alarming advertisements of the dangers of coffee by the manufacturers of substitutes for that beverage, keeping the patient in a state of terror for fear of "coffee heart" and various other fictitious ills. In his clinic, Boas used often to say to a patient: "Take tomorrow morning your usual portion of black coffee, the next day the cream with hot water, and the next the sugar with hot water and then report which causes your unpleasant sensations," and very often it was not the coffee at all. It may be, of course, that some individuals are unfavorably affected by the volatile substance "caffein," which develops by roasting the coffee bean and acts on the nervous system, but, coffee or not, the morning is always a doleful period for the nervous dyspeptic, and he is prone to ascribe his unpleasant sensations to the cup of coffee. Actually, however, coffee acts as a stimulus to motility of the stomach, and, outside of damaged health, where it increases the heart beats unduly, gastric hypersecretion, which it increases, and diarrhea, which is exaggerated by it, it has never been the author's experience to see any harm arising from the morning cup of coffee, if taken after the breakfast and the food not washed down with it. For these various reasons many prefer tea to coffee, but, used in large quantities, this also has its ills; marked constipation often follows its excessive use from the excess of tannic acid, for in the homes of the poor and the kitchens of the rich for the servants the teapot stands upon the stove the livelong day, freshened only by the addition of new tea leaves. Tea and coffee, both in small quantities, in a tablespoonful, form an admirable adjuvant to a glass of milk when there is distaste present, and undoubtedly add to the digestion.

Cocoa and chocolate are true foods, and their content in theobromine (or the "deadly emetic," the Battle Creek would call it) lies between either coffee beans and tea, which has more. Cocoa cooked with half milk and half water has no inconsiderable food value. For instance, its protein to the per cent, its fat 1 per cent, and its carbohydrate 5.2 per cent. The Holland varieties often contain potash, soda, or magnesia added by the manufacturers to make them more soluble, and hence are not to be recommended to those with digestive disturbances.

On account of their large content in fat and added sugar, these prepared cocoas often cause heartburn, which disadvantages have been somewhat overcome by the "digestible" cocoas which are on the market and which can generally be taken by the possessors of the weakest stomach. A rather interesting observation has been made by Prager, that the addition of milk to cocoa and cream to coffee delays their departure from the stomach an hour.

Alcohol has been a bane of contention for many years as to its nutritive value. Thirty years ago, in pursuance of a state law, it was the author's duty to teach the use of alcohol, but after a short period the discovery was made that it was the abuse, and not the use, that was to be taught, for, as the academy trustees gravely stated, "it had no use"; yet it has been demonstrated again and again that, through its power of sparing both the fat and protein of the body when ingested, it is not merely a beverage, but at least a "near food." Still, on account of its toxic properties, when its use exceeds a certain limit, it must be employed with great caution. The healthy adult is able by the possession of antidotal powers in his body to neutralize partially these toxic effects, much as is done with the products of autointoxication, but those suffering from nervous diseases, especially neurasthenics, have largely lost this power. The effect of alcohol on the digestion in small quantities is to increase both secretion and motility—in large quantities, to paralyze them; hence alcohol should not be allowed when gastric hypersecretion is present, but may be used after the meal is eaten by those whose gastric motility is impaired. "Take a little wine for thy stomach's sake" is just as good advice now as two thousand years ago, but it is to be amended by interposing post cenam. The vicious habit of drinking alcoholics before breakfast and the cocktail before a meal cannot be too severely reprehended. The most satisfactory wines are those freely fermented—varieties known as Rhine wines, Niersteiner, Hochheimer, etc.—but which can be produced equally as well in California; in fact, from the author's personal knowledge much wine from that state has made the journey to Germany in casks to return to this country in flasks as imported Rhine wines, mixed, of course, with a portion of the real article. When the wine is too acid, a little alkaline water, like Vichy, may be added, as is the custom in Vienna. When wine disagrees and produces heartburn, it is reasonable to assume that it was made from unripe fruit, and the same is true of oranges, lemons, and strawberries when they cause heartburn, for ripe fruit juices will not do this. Freshly fer-

mented new wines are to be avoided, and this is the very reason that California wines are apt to disagree in that they are marketed before age has had time to remove the substances like fusel oil and yeast remnants, which have a toxic action on the nervous system and fermentative action on the foods in the stomach. To what extent the various "processes," widely advertised, are supposed to free the new wine from these deleterious substances is difficult to say. Special wines have won great renown for their favorable influence on certain diseases like elderberry and huckleberry wines for diarrhea, cider and rhubarb wines for constipation—and undoubtedly they do affect such disorders favorably. Even the infusion of dried huckleberry has a favorable influence on intestinal catarrh, an action which is undoubtedly due to its tannic acid content. Of the various cocktails and bitters said to arouse appetite and improve digestion, our best advice to our patients is to let them alone and confine themselves to a liquor glass of good brandy or whisky, well diluted, after the meal, for, if taken undiluted, many complain of the burning produced by it. Champagne is of great service where nausea is present and rapid action is desired, because the carbon dioxide dulls the sensitiveness of the stomach and hastens absorption. It is unwise to give it to invalids, however, with its full charge of carbon dioxide, a portion of which should be allowed to escape, nor should it be given ice-cold.

The unfermented sterilized fruit juices, such as grape juice and orange, are admirably adapted to produce a laxative effect on the stool and are equally as well suited to overcome the putrefaction in the colon as buttermilk, which has found so many earnest advocates. Incidentally nothing can be better adapted to stimulate the secretion of urine than these fruit juices. We must assume, however, that no antiseptic is used in their preservation.

Alcohol should be forbidden to those suffering from gastric disorders, but not necessarily from gastritis, for the following reason: it is usual to take it early in the morning on account of its few irritant qualities, especially existing in the stomach, generally the result of which is however, as a rule, a very liable to produce a constipation, especially from the acids produced by their fermentative action. The use of alcohol is easily avoided by sterilizing fruit juices, however. Wine is not to be taken due to a number of reasons, however, among which are the Würzburg, a disease of the liver, and the fact that it is a stimulant, which is not a good quality.

CONTENT OF SOME ALCOHOLIC BEVERAGES.

Percentage of the different ingredients.	Alcohol.	Extractives.	Sugar.	Tannic acid.	Tartaric acid.	Calories per table spoonful (20 c.c.).
Rhine Wine	8	2.6	0.85	.....	0.81	12-15
Elderberry or Huckleberry ..	8.55	2.87	0.62	Vari- able	0.65	12-15
Sherry	17.45	3.98	0.52	2.12	0.45	26
Brandy	69.5	0.65	...	.....	...	100
Whisky	36.5	0.25	...	Vari- able	...	55
German beer	3.93	5.79	0.88	.....	0.19	10
American beer	4.45	5.92	...	.....	...	10
Malt (liquid) extract	3.94	5.13	...	.....	...	10
						Glass, 120

CONTENT OF SOME LIQUID FOODS AND CONDIMENTS.

Percentage.	Water.	Protein.	Fat	Carbo- hydrates.	Cellulose.	Lactic acid.	Alcohol.	Calories per glass.
Whole milk	87.4	3.4	3.6	4.8	..	..	..	160
Cream	65.5	3.6	20-21	3.52	..	..	..	450
Condensed milk without sugar	53.5	14.6	14.0	15.3	..	..	..	Teaspoon, 70
Buttermilk	90.2	4.0	0.9	3.7	..	..	..	80
Koumiss or kefir (2 days)	91.0	3.3	2.2	1.9	..	0.35	0.53	113.5
Beef tea	97.5	0.3	0.2	1.25	0.4	..	..	5-20
Cocoa (2½ teaspoons to half cup each milk and water	88.2	3.6	4.0	5.0	..	..	..	181.1

As reference has been made to calories, by which measurement we determine whether patients are receiving nourishment commensurate with their weight and state (rest or activity), it would perhaps be well to briefly state the method of determining the caloric value of food, though tables are now prepared like interest tables which give all the combinations. For instance, an individual in bed, weighing

150 pounds, requires 1,800 calories, and at hard work, 3,000. Each gram of every food element has its caloric value, as follows:

1 gram protein	4.1 calories
1 gram carbohydrates	4.1 calories
1 gram fat	9.3 calories
1 gram alcohol	7.0 calories

Hence in the last instance, not knowing the caloric value of a cup of cocoa, the calculation was made as follows: a cup (250 c.c.), with 3.6 per cent protein, contained 9 grams, with a caloric value of 9×4.1 or 36.9; an amount of fat equal to $250 \times .04$ or 10, with a caloric value of 93; a carbohydrate equal to $250 \times .05$ or 12.5, with a caloric value of 51.2, or a total caloric value of 181.1. When we stop to consider that even in bed a moderate-sized individual must drink ten cups of cocoa daily to obtain the required 1,800 calories, or $2\frac{1}{2}$ quarts, we see the improvidence of attempting to nourish with liquid food alone, and pass to the next division.

SOLID FOOD.

Solid food is undoubtedly more difficult of digestion than liquid, leaves the stomach much more slowly, and is more difficult of absorption than the latter. It also demands much more thorough cooking and better mastication than the latter, especially for those suffering, as they call it, from "stomach trouble."

Eggs afford the most concentrated of all foods, and are generally acceptable to all. One egg weighing from $1\frac{1}{2}$ to 2 ounces is equivalent to $1\frac{1}{3}$ ounces of fat meat or $3\frac{1}{2}$ of a glass of milk. When we come to consider the digestibility of eggs, we must remember that they form a fatty food, the fat and protein content being nearly alike (5 and 6 per cent); hence some complain of being made "bilious" by them, probably from their fat content. Therefore great care must be taken in the method of cooking for weak digestions, many complaining that a hard-boiled egg "lies like a rock" in their stomachs, or may even produce pain. This probably depends on the difficulty of liquefaction of the hard lumps of egg albumin, which irritate a sensitive gastric mucous membrane, for, when one has reduced these fragments to a powder by a grater, their ingestion causes no difficulty. Fried eggs also cause delayed and uncomfortable digestion in the patient and should be avoided; hence the best methods of cooking for a weak digestion are the "soft-boiled" or "dropped" egg, in which the albumin is

brought to a state of light coagulation. Scrambling with a modicum of butter, or beating well and pouring into boiling bouillon, the "Suppe mit Ei" of the Germans, are also suitable methods of preparation. Recently, unfortunately, a vicious habit has sprung up of breaking large numbers of eggs—good, bad, and indifferent—into cans, or drying them, and employing for cooking. Many of these cans contain ptomaine-like bodies from decomposition, and ptomaine poisoning from ice cream and mayonnaise dressing has been common. The government has stopped the importation of these from China, and the supply from the Middle West coming under interstate law is closely scrutinized and much diminished. For the methods of cooking mentioned and to take raw with milk, only the freshest eggs should be employed, and it is with alarm we view the fact that the price of such has soared above the means of a laboring man, for it is often his improperly nourished children who need them most. It is amusing to note the efforts of the pharmacists to establish a sale for lecithin, with its valuable glycerophosphoric acid, when the yolk of every egg contains it in generous quantities. For those who can afford it, the Russian caviar, with its 30 per cent of protein and 15 per cent fat, serves the same end as eggs, and as an appetizer before a meal it far surpasses the cocktail and is less harmful.

Meat, as far as digestibility is concerned, is judged by its amount of fat, for the more of this there is the more difficult it is for the gastric juice to penetrate the albumin and the longer it takes to leave the stomach. Based on this criterion, we find the white meat of fowl, veal, and sweet-breads to be the most digestible. All of these meats, too, have a softer consistency, a quality which calves' brain shares, but contains a large amount of fat and is less adapted. When it comes to extractives, as Senator remarks, we must give our attention not only to the nitrogen-containing, but the nitrogen-free variety, and, while the former differs but little in light and dark meats, there is a marked difference in the latter. For instance, beef has 0.46 per cent nitrogen free extractives when raw, and 0.76 per cent when cooked, while veal under like conditions has respectively 0.07 per cent and 0.4 per cent. As far as raw meat is concerned, if it is well chopped and the coarser tendons removed, with a normal gastric juice, complete utilization takes place in the intestine, but attention has already been called to the former frequency of its use by physician's orders in children and the increased prevalence of tapeworm. This might not happen again on account of more careful inspection of meats by the United States authorities, but one feels safer when meat is cooked.

A table of periods at which the stomach is free from meat remnants after a meal varies from two hours and twenty-five minutes for boiled calves' brain to five hours and twenty-five minutes for roast mutton, all periods being pretty closely allied with the fat content of the meat. Thus arranged according to fat content and digestibility, we would have:

	Fat.
Sweetbreads, veal, pike, oysters, and haddock	0.4—1 per cent.
Beef, hare, chicken, squab, and partridge	1 —1.5 per cent.
Mutton and pork	5 —7 per cent.
Goose, caviar, herring, salmon, eel, and mackerel	over 8 per cent.

In general, it may be said that rare meat is better digested than thoroughly cooked, but the meat must first be hung up for a long time to ripen, which softens the connective tissue by the action of post-mortem formed lactic acid, while the myosin coagulation is softened by the action of a growth of harmless bacteria. Still, this process of ripening should not be allowed to continue too long, for the smallest amount of deleterious substances produced by putrefaction may harm a weak digestion. Very often roasted meats are best eaten cold, and a sandwich made with stale bread and cold roasted meat makes a food well taken care of by the weakest stomach, either as part of the chief meals or as an adjuvant meal at 11 A. M. and 4 P. M. Another excellent form of employing meat is in the use of Hamburger steak, or, what is better, meat cut at home by a meat cutter, for a better selection can be made at the market. Meats prepared in this way can be steamed or baked, and not fried, as is unfortunately often the custom. In the restaurants we can usually obtain them as minced chicken, lamb, fish, etc., on toast, or as the much maligned hash, which, properly prepared, is a food par excellence, and throws the least burden on the digestion on account of the minute division. Fowl is much more readily digested when boiled or fricasseed than when roasted. Of game, venison and hare are to be given the preference on account of the lack of fat, though the fiber is coarser than that of beef, but by appropriate cooking this disadvantage can be somewhat overcome. The age of the animal has also something to do with the digestibility of the meat, and that of young animals should always be chosen for invalids because more tender.

Preserved meats—tongue, ham, corn beef, and dried beef—should not be used by dyspeptics except in emergencies, and then in small quantities, since they always retard the gastric digestion and are poorly utilized. Canned beef loses its extractives and phosphoric acid largely

by the process of curing, thus decreasing its palatability, as the round robin of the Spanish-American soldiers in regard to the "embalmed" beef showed. Ham should be lightly smoked or "sugar cured," and should never be eaten raw for fear of trichinæ, though more digestible; ox tongue contains much fat, and the tip a very coarse fiber; sausage should be avoided on account of its excess of fat and numerous spices, but the interior of Frankfurters, on account of its finely divided state, has proved satisfactory to the author with patients possessing atonic stomachs.

Fish, on account of its large water content, is often regarded as less nutritive than meat, but erroneously so, for it contains a large amount of albumin and substance yielding gelatine. One of Atwater's services to dietetics was to show that 1,500 grams of haddock was equal to 1,200 grams of beef in actual nutrient value, so that fish can be compared favorably with veal in that respect. The lean varieties—like haddock, trout, perch, pickerel, and sole—are to be regarded as easily digested and allowed, while the fatter kinds—sword fish, mackerel, halibut, and salmon—are to be forbidden. As to the digestibility of oysters, opinions differ, but raw, with lemon juice, if their source is unquestioned (typhoid), they have served the author admirably; paned or cooked in their own juice, they are equally digestible; but as a stew, cooked with milk and butter, they often cause gastric distress.

Bouillon and *beef tea* both lost their renown as foods when we began to actually calculate their nutritive values, which are: protein, 0.3–1.8 per cent; or from veal possibly as high as 2.8 per cent; and fat, 0.2–0.4 per cent. Of extractives, however, the percentage may rise to 3.6 per cent, and in this lies their value in that they arouse appetite and the flow of gastric juice. Tell any patient who complains of loss of appetite in the morning and the sense of not having rested, to begin the day, if possible, or even before retiring, with a cup of beef tea, and note his satisfaction with this method of arousing the appetite. On account of its power to excite and increase gastric secretion, it should never be used when there is an excessive flow of gastric juice, and from the fact that these meat extractives contain large uric acid producing residues and usually raise blood pressure, bouillon should not be given to the gouty or to those with impaired arteries. Whether soup should be taken before the main meal, as is the custom, depends, of course, on the gastric motility of the patient. When that is impaired, he should certainly refrain, because the percentage of nutriment is so low that there is not adequate return for the extra

burden the stomach has to bear. With bouillon and beef tea are to be reckoned the regular beef extracts, like liquid beef, which is the cold pressed juice of fresh meat preserved in some way, and the various raw and cooked blood preparations on the market. Their analyses as sold sound attractive, but, when diluted as directed and the resulting product analyzed, we find we are in the realm of attenuations so praised by one of our schools of medicine. In justice to many of these preparations, it should be stated that the protein is partially digested, which makes them more acceptable to an impaired stomach.

The predigested albumin, either of animal or vegetable origin, or a mixture of both, either as powder or liquid, is found on the market in the form of a number of preparations, and has a limited value (1) as addition to liquid food (milk or bouillon) to increase its caloric value in fevers, wasting diseases, and in building up the patient after acute diseases or operations; (2) in arousing appetite with diminished gastric secretion (anemia, neurasthenia, etc.); (3) where both secretion and motility are impaired; (4) where, as sometimes happens, nourishment must be given through a tube or by rectum. Of all these predigested meat preparations it may be said that, when used to a large extent, they produce diarrhea and appear in the urine, though merely as an adjuvant to other foods they rarely do this; and also that, considering their actual food value, the price appears exorbitant. As all of these preparations have their adherents, and enthusiastic testimonial writers have expressed their encomiums on them, it is the author's duty to refrain from naming them other than as a group, only remarking that they can be recognized on the label by the word "predigested," which is supposed to convey some magic charm.

Casein and its *modifications* form another group of ready-made, if not readily digested, foods, which is chiefly distinguished from the former by its lesser price. Modified by the addition of some alkali to satisfy its acid properties, this class of prepared foods seems to be better utilized than the group from meat (93.3 per cent of the former, 82.7 per cent of the latter). Then, starting from casein as a basis, all imaginary combinations have been devised until we have reached in the newest effort a casein-iron-lecithin compound.

Vegetable protein, gluten, has also been called on to furnish a new nerve food, at least two varieties of which are on the market. At first the taste of these preparations left much to be desired, but recently it has been so much improved that no complaint is made by patients in that regard. This group, too, is favored by the low cost

and freedom from starch, which latter factor allows it to be used by diabetics.

Gelatine-containing food preparations all come from gristle, tendons, connective tissue, and bone. Apart from the French gelatine, it is put up in attractive packages, often flavored with fruit juices, and requires only the addition of boiling water, when it can be molded into attractive forms and served with cream and sugar. This gelatine has been found to be wholly absorbed in the intestines, and, on account of its rapid assimilation in the tissues of the body, has proven to be a sparer of both protein and fat, thus proving an admirable aid to the nitrogen increase of the body. More recent investigations show that it can replace body protein only to the extent of 61 per cent, but in small quantities emphatically prevents its loss. Gelatine cannot be employed beyond a limited extent, else it produces irritation of the intestine and diarrhea. Furthermore, gelatine has been found to combat the tendency to hemorrhage, not only when injected subcutaneously, which, unfortunately, has sometimes produced tetanus, but also when given by the mouth or rectal injection, though less rapidly, and has proven very valuable in melena neonatorum and slowly bleeding gastric ulcer.

Fat, too, forms a very important part of our nourishment, since, like gelatine, it is also a protein sparer to the extent of 7-15 per cent. Recently, as mentioned, a part of the fat digestion has been found to take place in the stomach, either from an inherent ferment, or, more probably, from the reflux of duodenal contents through the pylorus, but the greater part must take place in the intestine, and demands the normal secretion of the liver and pancreas as well as their free discharge into the tract. The use of fat as food undoubtedly lessens gastric hypersecretion, and probably does not retard motility as much as has been formerly supposed; at least H. Strauss and B. Cohnheim have claimed a very beneficial effect of abundant fat ingestion in disturbances of gastric motility. It has also been found that, in marked disturbances of the intestinal functions accompanied by diarrhea, fat is often well borne, well utilized, and exerts a powerful influence in staying the failing strength of the patient. The fats most commonly used and most easily digested are butter, olive oil, and oleomargarine; the last—though various parties producing real butter have demanded and in some states secured by law that it shall be colored pink, etc., ostensibly to prevent deception, but really to produce distaste for it—is really a very nutritious and harmless preparation, though not equal in food value, pound for pound, with true butter.

since some of its fats are of a higher melting point and hence less well utilized. Still, with true butter at the exorbitant prices of the last few years, oleomargarine has proved a blessing to the man of limited means, and, if distinctly labeled, so that the purchaser may know that he is buying an inferior but no less healthful food, just as when he buys an inferior coal, no harm can be done. Cocoanut butter and cotton-seed oil, most common in the form of cottoline, are now used largely for cooking as substitutes for lard, whose price has also soared, and apparently with relief to the individual's purse and no harm to the patient's health. One of the very best methods of administering fat is by the use of cream, because it can be better regulated, and often the author's advice to patients is to buy a half pint of thin cream (20 per cent) daily, and take the same salted on baked potato, sweetened on stale bread, and richly in tea, coffee, cocoa, or even to enrich the milk, but never to drink undiluted, for the best stomach will often rebel at the excess of fat. Olive oil, if good, which is rarely true of the variety found in our best restaurants, can be taken freely on almost any cold boiled vegetable, or on lettuce, water-cress, etc., perhaps with some lemon juice for a flavor, or a wineglass of the pure oil taken night and morning, which, especially if cooled in a refrigerator, may be swallowed without any difficulty, thereby soothing the irritated mucous membrane of the stomach, reducing its secretion, and often producing a daily stool, provided that gastric motility is not impaired.

Cheese, though extremely nutritious, containing, according to the variety, 24-32 per cent of albumin and 4-30 per cent of fat, is not so readily digested on account of this very fat content. In one of the author's earliest medical works this distich was found:

"Cheese is a surly elf,
Digesting all things save itself."

In a rather wide experience, not only has this proven true, but, what makes it still more emphatic, is firmly grounded in the minds of the laity. Still, in the author's practice use is often made of Neuchatel, with good results, and Wegele recommends highly the Parmesan cheese, well grated, as it is usually served, on account of its lessened fat content. Salkowski, too, recommends the use of casein in place of the peptone preparations, and Rubner has found that cheese added to milk, or taken in conjunction with milk, increases the utilization of the latter by producing a finer curd. Late investigations have shown that Roquefort and Chester cheese remain the shortest time

in the stomach, but their use cannot be recommended for dyspeptics on account of the addition of condiments and their stimulating bacterial products. Various preparations have been employed to increase the fat content of the diet, most of which rest on codliver oil and egg yolk as a basis, and are "flavored to taste," as the cook-books read. We are now skeptical in regard to any therapeutic value which cod-liver oil may have other than dietetic, but it does seem often the real adjuvant needed to regulated diet to put our patients on a weight increase. Unfortunately many complain of eructations after its use, and possibly, if some of the fat existed as fatty acids, like the German lipanin, this might be overcome.

COMPOSITION OF FAT RICH FOODS.

	Water.	Albumin.	Fat.	Carbo-hydrates.
Butter	14.49	0.71	83.27	0.58
Oleomargarine	10.5	0.1	85.8	
Lard	0.71	0.12	98.10	
Fatty cheese	39.09	25.09	29.05	2.22
Fat poor cheese	43.87	34.99	11.37	5.40
Chester cheese	33.96	27.68	27.46	5.89

The carbohydrate-containing foods continue their digestion, as noted, during their stay in the stomach, thanks to the ptyalin, until the secretion of hydrochloric acid has reached a point where the process is interrupted, and even then the interruption may occur only on the periphery of the food mass in the stomach. Although the entrance of the acid gastric contents into the intestine produces a free flow of pancreatic juice, a too acid content hinders very much the duodenal digestion; but, even when neither bile nor pancreatic juice can make its way into the intestine, digestion of starch goes on, and often its utilization is complete. The investigations of many have shown that the ingestion of carbohydrate food tends to inhibit albuminous putrefaction; in fact, no evidence of the latter can be found on a purely vegetable diet. This is of particular import in achylia gastrica where the intestinal disturbances have been brought on by the use of meat. Still, the time has passed when man can economically sustain himself on a purely vegetable diet, for, though his nitrogen equilibrium can be maintained, he must devour such enormous quantities of material to keep himself in normal condition that the digestion suffers. The Scotchman has a powerful physique, not on account of oatmeal, but his vigorous body has enabled him to live on oatmeal. When, however, to a vegetarian regimen we add milk, eggs, cheese,

and butter, we often have the ideal diet for nervous dyspepsia, even when there is a tendency to flatulency and autointoxication. It often happens that when dealing with anemic patients we often wish to select a suitable diet which shall be rich in iron, and the following brief table will give some knowledge of the comparative amounts of the same:

	Percent.
Potato	0.247 ferrous oxide
Carrots	0.056 ferrous oxide
Lentils	0.041 ferrous oxide
Apples and pears	0.02 ferrous oxide
Strawberries	0.009 ferrous oxide
Spinach	0.002 ferrous oxide

The cellulose of young vegetables is largely digested by the saliva and pancreatic juice, but mostly by the intestinal bacteria. Especially is this true of spinach, asparagus, and carrots, where the utilization of cellulose amounts to 47-63 per cent. In this process marsh gas and organic acids—carbon dioxide, acetic and butyric—are formed, which are subsequently fully oxidized and utilized, thereby becoming fat and protein spares. For the nourishment of those with diseased digestive organs, particularly with stenosis, it is much better to choose those vegetable foods which contain but a small percentage of cellulose.

The cereals, which are used largely by humans for food, consist chiefly of wheat, rye, barley, oats, rice, and corn. In recent years, however, much to the disadvantage of the human race, wheat, and particularly the white finely bolted flour made from it, has become the staple of life, to the neglect of the others, which perhaps pose as ingredients of the various breakfast foods whose identity is difficult to trace on account of the diverse mechanical processes which they have undergone, like "puffing," "cracking," "toasting," etc. All of these grains, with the exception of hulled corn and rice, are eaten after grinding, by which the hull of cellulose is usually removed, thereby doing away with the whip of the intestine. From the wheat we have the white bread, almost universally used by us; and from the rye the black bread, used largely by foreigners; and from corn, brown bread and corn cakes, used by our forefathers who conquered the land, but only a memory to those of the present day. To those who suffer from gastric fermentation, the black bread is unsuited, because, made from sour dough, it encourages such processes; this, however, in the author's experience can be largely overcome by toasting the rye bread before it is eaten. The white bread prepared with yeast exhibits in

a much less degree this tendency to fermentation after it is eaten, while the Hosford and other baking powders of allied nature (usually composed of sodium bicarbonate or saleratus, and either potash bitartrate or cream of tartar, aluminum sulphate or alum, or acid calcium phosphate) have made fortunes for many manufacturers, and incidentally, in the form of hot biscuits, a race of dyspeptics. The crust, on account of the partial conversion of its starch to dextrins by the heat, is more digestible than the soft inner part of a loaf, an advantage which accrues to the whole loaf by slicing and toasting, or used in the form of zwieback. Fresh bread has long possessed in the minds of the laity the quality of being more indigestible than stale bread, but in all probability this apparent disadvantage is only one of greater difficulty of thorough mastication, without which the digestive juices cannot so thoroughly mix with it. When fresh bread is carefully masticated, it does not suffer in digestibility in comparison with the stale variety. The harder varieties of bread, like rolls and toast, must also be softened, as in the form of milk or cream toast, or else an equal amount of care must be taken to masticate them, for it is no uncommon thing to find in the gastric contents, after the Ewald breakfast, fragments of the crust, readily recognized by its color, which are entirely unattacked by the gastric juice, while the softer portions are finely divided. Graham bread or whole wheat bread, which contains the ground hulls of the grain, demands a normal digestive juice at least for their employment, but are very efficacious in stimulating intestinal peristalsis. Cereals can also be advantageously employed in soups, either as flour thickening or by the addition of the grains—rice, barley, etc.—whose starch is largely converted to dextrin by boiling. Too much dependence should not be placed on its caloric value, however, for such soups have been found to contain 90 per cent water, 1 per cent albumin, 1.5 per cent fat, and 5–6 per cent carbohydrate; very rarely does the latter constituent reach 10 per cent. Especially those soups in which the cooked grain has been rubbed through a sieve before it is eaten, or to which the ground meal is added, have won great renown since Hippocrates first recommended them—known to him as “*ptisans*,” to us as broths. Barley, oats, and tapioca make a particularly slimy or mucilaginous mixture, which are supposed to act as a soothing application to the digestive mucous membrane, but probably are valuable only by their ready digestibility. Gruels, containing much the same constituents, but prepared with milk, have also had a wide use in the feeding of the sick. According to Leube, soups containing the whole grain—barley, rice,

oatmeal, sago) incite in a marked degree secretion of gastric juice, and are very valuable where such an effect is desired. The use of breakfast foods, so common with us that every restaurant must keep on hand a dozen varieties, can be and is often carried to excess, for the hulls, particularly of oatmeal, are difficult to dissolve and must produce some irritation. Perhaps it is better to keep these in reserve for the same purpose that we use Graham and whole wheat bread—namely, to stimulate peristalsis in an atonic colon. In the author's estimation it would be much more desirable to make a more common use of rice, either in soup, as a breakfast dish, or as a vegetable, so common in the South. The Japanese have developed a very sturdy race on rice and fish, and it is a misfortune of our country that so much rice is exported and so little eaten at home. Rice must, however, be so thoroughly cooked that the grains will almost fall apart, and perhaps its improper cooking may have retarded its popularity. Rice and Indian corn meal, too, can be made into very palatable and nutritive puddings, but many of the later ventures of cooks with the glory of New England, an Indian meal pudding, have been dismal failures, if one can judge from what is presented to the patron of our best hotels and restaurants.

The *leguminous vegetables*—pease, beans, etc.—are particularly noted for their large protein content (25 per cent), and also their excess of carbohydrate (50 per cent), and hence should be the ideal food, particularly for the poorer classes because inexpensive, compared with an equal amount of protein and starch in other forms, provided, of course, that long continued cooking has rendered their elements available. The modern method of treating these leguminous like wheat by conversion to pea or bean flour, or split pease, has brought them into the dietary of the sick, and a soup made of these prepared leguminous is well borne by the weakest stomach. So great a difference exists in the absorption of these two forms that Strümpell has found that 91.8 per cent of the protein of the ground variety is utilized, while only 39.8 per cent of the whole vegetable is available. The New England baked beans have won a reputation for indigestibility, but it is often found that the difficulty is caused by the large amount of fat—pork used, and that beans baked with mutton or butter may be eaten without producing any ill effects.

The *green vegetables*, or those growing undigested, have by no means the high food value of the former. Their comparative values lie between 10-30 per cent water, 1-2 per cent protein, and 5-20 per cent carbohydrate with the exception of sugar and starch, which have

85 per cent of the last. Probably the most extensively used and best liked of this group is the potato, which, according to Rubner, does not deserve this extensive use, but is rather only a "near food." Either baked or mashed, this vegetable nevertheless affords a ready means of obtaining one element of our ration—carbohydrate—of which the ordinary individual must have 500 grams daily in an inexpensive and thoroughly economical form, for, even when feces show marked waste of meat and fat, rarely does one find any excess of starch. Prepared in these ways, too, the weakest digestion can usually dispose of its portion without discomfort. When, however, a race attempts to sustain life on the potato alone, as did the Irish at one time, the result is disastrous, as shown by the ravages of tuberculosis among this people. Turnips, beets, and radishes are much less available for the weak digestion, and have decidedly less nutritive value because of their excess of cellulose, but may be used to advantage in combating intestinal torpor. For their nutritive value, too, we may use the young beet and the small white turnip, which, if it does not contain too much of its characteristic oil—i.e., is not too "strong"—can be made very palatable, but should always be eaten mashed. Carrots and parsnips, too, particularly when the latter has been allowed to remain in the frozen ground through the winter, by which it becomes very tender, form a very palatable and easily digested group of vegetables, but are not to be compared in utilization with mashed potato, squash, or young white turnips. Sago and tapioca, made respectively from the pith and roots of shrubs, by their process of isolation are made very soluble and digestible, but must not be depended on for nutrition on account of their meager protein content. Taken in soup, where the fat and protein are furnished by meat or egg, or as a dessert in the form of pudding and accessory to a meat course, they form a valuable adjuvant because so readily digested and completely utilized. The green vegetables—lettuce, spinach, water-cress, and the cabbage family, cabbage, cauliflower and Brussels sprouts—had best be stricken from the dietary of the dyspeptic because they contain so much cellulose and so little nutriment, and the latter particularly produce much gas. Sourkraut, in the author's experience, has in a much less degree these disagreeable effects, and, cooked with sausage or meat, retains enough fat to make it contain a moderate amount of nutriment. All these vegetables have a distinct use in acting as a whip to the intestine when sluggish, in serving as a vehicle for fat, and convincing the diabetic patient that he is really eating something, for their volume often gives a sense of comfort to the stomach. Only

the tenderest portions of asparagus and celery should be allowed patients with "stomach trouble," as they call it, for fragments of them can usually be washed out of the stomach the next morning when eaten the evening before where motility is but slightly impaired, and the long fibers often pass through the entire tract without change, and greatly distress patients who observe their stools, who think them worms. Their power of "nagging" the intestine to response is the same, however, as other cellulose-containing foods. The salads made from these green vegetables should never be allowed where there is increased gastric secretion or impaired motility, because of the use of pepper, vinegar, mustard, etc., which stimulate secretion. A lettuce sandwich, with lemon juice alone, may sometimes be allowed. Potato salad, also, should be excluded from the diet of all sufferers from gastric disorders. As practically all of these green salads simply serve as a vehicle to carry large amounts of oil, having a high food value, into the stomach, this deprivation does not impair nutrition, as the oil can be taken in other forms. It is amusing in the clinic to note the instinctive knowledge possessed by the poorer people where every penny counts, of the lack of food value of green vegetables. Advice to use salads as a means to overcome constipation is met with a shrug of the shoulders and the statement that they cannot afford it, yet the dog and cat instinctively take to eating grass for the same conditions. We have heard much of the loss in food by allowing the mushrooms of the fields to "waste their sweetness (nutriment) on the desert air," and many glowing comparisons are made between them and beefsteak as far as their nitrogen content is concerned, but, in fact, mushrooms contain too much cellulose to be readily utilized by an impaired digestive tract, and are largely ballast, besides, unless cultivated from an approved seed, subjecting the consumer to a possible poisoning.

Fruit and berries contain, on an average, water, 84-90 per cent, protein, 0.1-0.7 per cent; carbohydrate, 2-6 per cent; acid, 0.2-2.4 per cent; and sugar, 1-10 per cent; though grapes may have as much as 24 per cent of the last. These sugars may be glucose, levulose, and cane sugar, while fruit may also contain dextrin and pectin substances. For those suffering from weak digestions, cooked fruit should always be recommended, because of greater ease of solution and the softened cellulose. The acid contained also plays a prominent part, and, for those having a tendency to heartburn, apples and ripe pears, with an acid content of 0.2-0.8 per cent, should be given the preference, rather than currants and oranges, with 2.3-4 per cent of acid. Strawberries vary so

largely in this respect that the variety in the early spring, shipped from the South green, can hardly be compared with those raised in the vicinity of the consumer and allowed to ripen on the vines. The author's advice is always to cook the former, while the latter may be eaten raw. The dried fruits—apples, prunes, apricots, and figs—can be given cooked as a sauce when no gastric irritation exists for their decided effect on increasing intestinal peristalsis, made much more effective by sweetening with molasses and less irritating to the stomach by being sieved—prune puff, etc. Out of season the canned fruits—or fresh fruits in jars, as they are sometimes called to distinguish them from the preserved form (which has a large amount of sugar added)—served with cream, form an admirable substitute for cooked new fruit. The exclusive use of grapes, the "grape treatment" so-called, for obesity and high blood tension, has had its adherents, but it is probably only a semistarvation treatment, for it may be always noted that, when a single article of food is used, the patient soon begins to partake of it less and less. The recommendation that both seeds and skins be swallowed is not without its dangers, for grape skin and seeds will remain a long time in an atonic stomach. Six months has been reported by one observer for the seeds, whose entrance into the appendix—though, of course, enormously exaggerated, since concretions were often mistaken for them—is to be avoided. The use of raisins to test gastric motility has sprung directly from these observations. The other berries—raspberries, gooseberries, blueberries, etc.—contain a large percentage of malic and citric acids, and hence are less desirable taken as such, but their pressed juice, diluted with water, makes an admirable drink, and is less liable to cause "burning" in the stomach in those susceptible to that sensation, probably due to the stimulation of the gastric juice. The juices of blackberries, cherries, and huckleberries have won some renown as a remedy against diarrhea, and, while the latter in dried form can be easily procured abroad and a decoction made of them, they cannot, as far as the author's knowledge extends, be procured in this country.

Nuts generally pose as indigestible, and are unsuited to those suffering from gastric insufficiency or irregularities of secretion. Those cured, as reported, in a marvelous way by an exclusive nut diet have simply undergone a period of undernutrition, and the favorable results have been due to that. From sweet almonds, however, an emulsion, which is official, is made containing protein, fat, and sugar, and which as an adjuvant to forced feeding in malnutrition is not to be despised, besides having a beneficial effect on intestinal catarrh; but,

as it readily spoils, it must be made up fresh. The acorn, on account of its 5 per cent tannic acid, may be added, when ground, to coffee or cocoa to overcome the laxative effect of either, on account of its astringent effect, and such a mixture can be used for mild intestinal catarrhs. Abroad this mixture goes under the names respectively of acorn coffee and acorn cocoa.

Sugar must not be omitted from the carbohydrates, first, because it is a widely distributed condiment, and, second, because of its marked food value. Formerly, up to the end of the middle ages, it was regarded only as a medicine, and now our government sends tons of it, made up into candies, to our soldiers in the Philippines. We employ grape, milk, fruit, and cane sugars; cane from the sugar cane (in the South huge stalks are found at the grocery doors in sections where the negro does his own refining) and from the beet; grape from all fruit and honey, and milk sugar, of course, from milk and cream. Different forms of sugar are only valuable for their flavor, since in the great melting pot of the body they all become grape sugar. According to various authors, sugar, when eaten, excites a flow of diluting fluid from the blood to the stomach which is without the constituents of gastric juice, and hence the employment of several lumps of sugar at midforenoon, midafternoon, and bedtime have proven very valuable in gastric hypersecretion, with "burning," when the stomach is empty, in many of the author's patients. Ewald allows his patients with gastric hemorrhage to first take sugar water by mouth, and the famous "honey water" of Hippocrates, employed in fever, must have depended on its large sugar content (30 per cent) for its therapeutic action. The sore mouth, of which individuals sometimes complain after the use of honey, is probably due to the formic acid deposited by the bees. Since honey is so frequently adulterated with glucose syrup, perhaps it is as well to depend on the thick syrupy extracts of malt, which are prepared under different names, and, while they possess no diastatic power, form an admirable means of maintaining the daily calories of patients who possess little or no desire for food. It can be taken in milk or on bread and butter, as the black molasses, dear to our childhood days, was. At present all imaginable things are put in the malt extracts, but they are worth only what their analytic value in maltose shows.

Condiments were formerly regarded as mere accessories to our food and not necessities, but at least one, salt, has been proven to be absolutely needful for a sound digestion. When salty food comes in contact with the mucous membrane of the mouth only, it excites a flow

of saliva, and, reflexly, at the same moment of gastric juice, an occurrence which has been amply proven on gastrostomized dogs and humans. There are those who insist that salt in the stomach produces an alkaline flow, the dilution secretion, instead of true gastric juice, but this is true only of large doses and not of the smaller portions used in food as a condiment. Even a pinch of salt in the morning glass of water can be easily demonstrated to incite a flow of gastric juice when this secretion is impaired (hypochlorhydria and achylia). Of the other condiments—pepper, mustard, horseradish, etc.—we can only say that, as they improve the flavor of food, they increase its digestibility because of the reflex activity of the gastric flow, and Mayr in his new work on intestinal torpor (Darmtraegheit) complains that persons accustomed to highly seasoned foods require much more Carlsbad water to produce free catharsis than others, showing that condiments are not without their influence on peristalsis of the intestine. This fact was known long ago to Da Costa, who called red pepper the "whip of the digestion." Constant use, however, of these irritating substances, like pepper and mustard, cannot fail to have some effect on the kidneys, by which they must be eliminated, and are supposed by some to have an effect on increasing blood tension. Their use should be forbidden in all cases of hypersecretion of gastric juice, but in achylia the free use of red pepper has served the author admirably. In later times saccharin has been used as a condiment in place of sugar by the obese and diabetics, but it must be remembered that, unlike sugar, it has no food value whatever, is a strong antiseptic, and is not well borne by those who, in conjunction with the affections mentioned, have a "weak stomach." The onion, too, like sugar, has a double function of condiment and food, but perhaps is oftener used for a condiment to give flavor to an otherwise tasteless mixture. On account of the peculiar oils which it contains, in many its departure from the stomach can be timed by the cessation of eructations of its peculiar mustard-like oil. After this arraignment, as the Good Government Association says of candidates, we do not recommend its selection where there is any impairment of digestion. Ginger has won some reputation as a stimulus to gastric digestion, and may be employed both as a condiment in food and as a medicine where gastric secretion is impaired, but for flavoring ice cream, cakes, etc., a little good vanilla meets all requirements.

CHAPTER VIII

TREATMENT OF DIGESTIVE DISORDERS

Only four means are in our hands for the management and control of the individual suffering from impaired digestive activities, either functional or organic—diet, physical treatment, medicinal treatment, and surgery—which belongs in this treatise only so far as indications for its employment may be discussed. Rarely do we depend on one alone of these means, but combine two or more in our efforts to remedy or stay the patient's disorder. An unfortunate view has sprung up that, when we call on surgery for aid, our functions as internists cease, but, in the author's experience, only when the surgeon has short-circuited a narrow pylorus by a gastroenterostomy, or suspended a looped colon with its often fantastic configuration, are we able to bring our forces most fitly and effectually into play, for the mechanical hindrance which has brought all our efforts to naught is now removed. A colon catarrh existing for years, which has secondarily invaded the appendix and forced its removal, can hardly be expected to vanish as soon as the latter event takes place, yet that is exactly what most physicians expect, and often express their disgust at surgery because the patient does not instantly recover.

DIETETIC TREATMENT.

Dietetic treatment of digestive disorders comprises the careful following of a diet list prepared by the practitioner, not by the manufacturers of some patent food, in which that food, of course, plays the most conspicuous part. This diet list should tell the patient what to eat, when to eat, and, briefly, how the food should be cooked or prepared. If certain articles of food should be avoided, that also may be stated, but a diet list which contains only negatives leaves the patient in a bewildered state, without any confidence in any article of food. The list must be adapted to the individual's occupation, both as to quantity (laborer or clerk), to his hours (night workers who sleep by day), and often, the author is grieved to say, to his pocketbook. Then, again, we must take into account religious restrictions—the Hebrew,

for instance, if following strictly the tenets of his religion, will not, of course, eat any product of the pig or oysters, and the Catholic declines meat on Friday. Let us suppose, for example, that we are dealing with a sufferer from gastric neurosis, who avoids food, because it incites distress or pressure after eating, accompanied by palpitation and subjective throbbing of the abdominal aorta, who has no religious objections to any kind of food, and can remain away from occupation or business. Such an individual would demand more calories than a condition of rest would otherwise claim—viz., 1,800; in other words, a "Mastkur," as it is known in Germany, and on account of the hyperesthesia there will be five or six small meals. We also take it for granted that examination has shown no marked variation from the normal in secretion or motility. Such cases we meet with almost daily. From either White's or Arnold's charts we can obtain our food values in household measures, and our diet list would then read as follows:

DIET LIST IN MALNUTRITION.

	Calories.
Before rising, a cup of hot cocoa should be taken, made of a teaspoonful of Phillips' digestible cocoa (50) and the upper portion of a jar of milk (160). A couple of oatmeal crackers (60) may be taken with this if desired	270
Breakfast.—Two hours after the first cup of cocoa, breakfast should be taken in bed—half a grapefruit (70), or an orange (75), or a baked apple (75) with two tablespoonfuls of cream (60), (avoiding skin and seeds); a small chop (150), or egg on toast (145), or omelet of two eggs (150), or two tablespoonfuls picked fish and cream (130), or two slices of crisp bacon (70), or a piece of broiled tripe, 5 x 3 inches (70), with a slice of toast (70), or a stale roll or muffin (70) warmed in the oven. Butter, one pat or ball (80), should be used freely on every article of food, as meat and bread. After the meal is taken a cup half of coffee and half cream, or the upper part of a can of milk (180), may be taken	385
11:30 a. m.—At this time a half cup of beef juice (170), made by expressing the juice from a lightly broiled piece of steak with a lemon squeezer, should be taken with a couple of saltines (30)	200
Dinner.—No soup; broiled, baked, or boiled meat or fish, piece 5 x 3 x $\frac{1}{4}$ inches (150), of any kind desired, without the gravy (made), but with plenty of the meat juice. This meat should be carefully minced with a knife by attendant or patient, or, better, put through a meat chopper. A roll and a pat of butter (195), two heaping tablespoonfuls of mashed potato (80), squash (40), spinach or cauliflower cooked in two tablespoonfuls of cream (60); two heaping tablespoonfuls of rice, sago, tapioca, bread, or custard pudding (160), or cooked fruit (140) with a tablespoonful of cream (30), average	610
4 p. m.—A cup of custard (275) or two tablespoonfuls of good ice cream	

(270), eaten slowly, with a slice of stale cake (75) or two sweet crackers	350
<i>Supper</i> .—A dropped or scrambled egg (75), or three-fourths dozen oysters, either raw or cooked, with some butter and flavored, or two slices each plain or cream toast, with two tablespoonfuls of picked fish (70), or smoked beef in cream	210
	2025

When diets are checked up in this way, one is often surprised to find that the calories sum up far less than are actually required to keep the patient in equilibrium. Another way, suggested by W. R. P. Emerson, is to have the patient keep an account in this homely way of household measures, of what and how much he eats voluntarily, which should be checked by these tables, when many an individual will be found to be undernourished. It is not, however, merely necessary to check up calories, but an examination of the feces should always be made to determine which ingredient of the food is least well utilized, and particular attention should be given to adapting or modifying that form—be it fat, protein (meat), or starch—to the needs of the weakened digestion and absorption of that special ingredient. Many a patient may be taking his full caloric ration, but through achylia—by which meat digestion suffers, or fermentative intestinal dyspepsia (A. Schmidt), under which starch digestion labors—our estimate of normal calories is sadly shattered, for the normal percentage of waste is vastly exceeded. This emphasizes most strongly that we can go on blindly adhering to an ideal made up of calories, because Rubner has shown that even in health a potato, possessed of a certain caloric value, imparts vastly more to the body's needs when mashed than when eaten as a salad. A mixed diet has always appealed to the author in all forms of digestive disease as particularly adapted to the needs of the patient, but, as we have so many advocates of sole, single, and exclusive articles of food, a brief consideration should be given them. In every case a single article of diet always produces inefficient nourishment, and, in fact, we are told that "Man should not live by bread alone."

Milk Diet.—Some uncomplimentary things have already been said of this exclusive mode of nourishing patients, based on the enormous quantity demanded and its insufficient utilization. We, of the old régime, who have seen our patients waste away to a shadow with the combination of typhoid and exclusive milk diet, all of which we attributed to the fever, have lived to see a bland mixed diet employed and the horrible emaciation of this disease checked. For gastric and

duodenal ulcer in their active form, for which an exclusive milk diet was apparently strictly indicated, the Lenhardt diet has shown its greater efficacy in checking loss of weight and allowing the ulcer to heal. When we find obesity combined with gastric hypersecretion in business men and others who are accustomed to eat well and drink better, an exclusive milk diet works admirably, because it checks the excess of acid, and its very fault (undernutrition) is demanded. Apart from the conditions mentioned, a diet consisting largely, but not wholly, of milk serves admirably in pyloric stenosis; chronic gastritis due to circulatory stasis; intestinal catarrh, particularly of the colon, on account of its little residue, if the digestive juices are not lacking: the dyspepsia accompanying anemia and ptosis, and certain instances of hypersusceptibility of the gastric mucous membrane, where vomiting is common without evidence of actual disease. This milk diet may be varied by the addition of egg, soft cheese, fruit juices, mashed vegetable, or baked potato and cream until such time as an occasional bit of broiled fish or chop can be introduced. Exclusive or largely milk diet is prohibited in gastric neurosis, apart from the nervous vomiting mentioned, for in every case the individual always feels much worse; in fact, the strict milk diet is often an excellent means of diagnosis in differentiating the former condition from gastroduodenal ulcer, which always gives less discomfort to the patient when rest and a modified milk diet is employed. Least of all is the large use of milk indicated in pure atony of the stomach, due to relaxed muscular walls and not to pyloric narrowing, for this relaxation is increased by the large volume of the milk. Chronic diarrheas also do not improve on a milk diet, though putrefactive changes cease.

Purely Vegetarian Diet.—The purely vegetarian diet has many adherents, but very few carry it out absolutely, regarding the absence of meat as constituting a vegetarian diet, but allowing milk, cheese, and eggs. With this interpretation we can agree better, for, owing to the scanty protein content of the purely vegetable diet, it produces an excess of fat and the impairment of muscle. Some of the photographs of the babies offered to induce parents to invest in So-and-so's food, known to be almost pure carbohydrate, prove better than words the truth of this statement. When, however, we make the additions mentioned and produce a lactovegetable diet, we have a nutritious, easily digested combination, adapted to many conditions. All vegetables must be thoroughly cooked, for one can have no patience with those who insist that food should be eaten raw, a condition of affairs so absolutely opposed to all the proven facts of the chemistry of digestion.

Furthermore, in order to obtain a balanced ration, fat in the shape of good butter must be added freely to all vegetables, or oil, taken abundantly on bland green vegetables, like lettuce or water-cress. By the addition of these articles, too, we raise the caloric value of such a diet to the body requirements and overcome the great failing of the vegetable—insufficiency of nutritive value. The advantages of the lactovegetable diet are the removal of the xanthin bodies or extractive substances of meat, which are closely allied with gouty disorders, the increase of arterial tension, and the formation of certain varieties of vesical calculi. Then, furthermore, the intestinal peristalsis is stimulated by the increased amount of fecal residue, due to the cellulose as well as to the organic acids and gases formed from the latter by means of bacteria in the colon. How much the psychic effect of such a regimen may have to do with the marked improvement seen is difficult to say; at least it is often possible to withdraw alcohol, tea, and coffee when the patient has been whipping up a flagging digestion by these means. The lactovegetable diet proves most efficacious in nervous dyspepsia, where the consciously difficult digestion is only one of the many symptoms, such as insomnia, vague neuralgias, or, as the colored people of the South call it, "the misery all over." When, however, there is a gastric motor insufficiency or an increased secretion, then our lacto-vegetable diet fails to benefit because of its too great volume and too great liability to incite rather than check the flow of gastric juice, which in turn retards the digestion of the starch in the vegetable food. Naturally, from what has been stated, this form of diet works most excellently in constipation, since the acids and gases formed stimulate peristalsis in the colon and hasten the passage of feces through it. In intestinal neurosis, where vague, mild to severe pains (which only too often turn out to be arteriosclerosis of the abdominal vessels), are complained of, this diet often works to perfection, relieving the spasm of the vessels, which is claimed to be the cause of the pain. The contraindications to this diet are diarrhea, all stenoses of the tract, and all ulcerative processes, whether of the stomach, small or large intestine, although Kelling makes use of it for the purpose of establishing diagnosis, either by increase and localization of pain or the induction of occult hemorrhage.

Salt-Free Diet. The salt-free diet, apart from its advantage in all edemas, with which we have nothing to do here, has been employed sometimes successfully in combating hypersecretion on the theory that the sodium chloride (from which the hydrochloric acid is made) must come from the blood, and anything which tended to diminish that re-

serve would reduce the acid supply. Furthermore, as a gastric or duodenal ulcer is always aggravated, if not caused, by an abundance of hydrochloric acid, a salt-free diet, which in reality is not salt free, but with a very restricted salt content, has proved very beneficial. Ordinary articles of food, arranged in a table as eaten, show the following increasing amounts of sodium chloride in a portion, as we understand it, or enough for one person for one meal:

	Amount of salt in one portion, grams.
Zwieback (3)	0.28
White bread (3)	0.37-0.52
Gravies	0.28-0.6
Dropped eggs	0.5
Cauliflower, mashed potato, or lettuce, cucumber, or celery salad	0.5 -0.9
Potato soup made with milk	0.7
Bouillon	0.75-1.5
Wheat grits or cracked wheat	1.7
Roast beef or chop	1.9 -2.8
Scrambled eggs	2.4 -2.7
Asparagus	2.7 -3.5

From this table we learn that foods with small salt content are eggs, cereals, vegetables, and milk. Butter must always be unsalted, and bread must either be prepared free from salt or zwieback must be used. Soups must be made of milk, thickened with potato or flour, while bouillon must be avoided. All vegetables must be boiled in water, without salt, and a teaspoonful of meat extract may be added for flavoring. Potato must either be baked or mashed, and eaten with cream and without salt. Salads may be prepared with oil and lemon juice. Eggs may often be taken raw, well beaten, with sugar, and perhaps a dash of nutmeg. Light puddings of flour may be made, without salt, and be eaten with a sauce containing some fruit juice, when the absence of salt will not be noticed. How far this restriction in the use of salt may be carried can be learned only from experience, and depends largely on the patient. Some can get along with two grams daily, while others with five grams will show the effects of the abstinence, which consist of a distaste to the unsalted food, which may become so great that patients refuse all food. At least it is always desirable to make a trial of this diet when a gastric ulcer and its accompanying hypersecretion exists.

PHYSICAL TREATMENT OF DIGESTIVE DISORDERS.

Physical treatment of digestive disorders, next to dietetic, plays the most important part, comprising, as it does, the employment of water, gymnastics, and electricity.

Hydrotherapy.—Hydrotherapy, in spite of its vast effects in medicine, is too little emphasized in teaching that subject and too little understood. After seeing the magnificent hydrotherapeutic establishment at the Eppendorf hospital at Hamburg, one looks in vain in our country for an equal establishment. Still, in a small way, institutes are being established in the larger cities, and meantime we can carry out in the poorest dwellings, at least in those that have running water and a fair pressure, a modified hydrotherapeutic treatment that, while not ideal, serves our purpose very well.

1. The morning cold sponge or rub is perhaps the simplest form of procedure, and one which will be most generally employed. The patient should dash water at a temperature of 52° F. over the entire body, or squeeze the water from a sponge, paying particular attention to the abdomen. Better still, the water may be poured from a pitcher over the body, after which the body is to be rubbed with a wet towel and slapped with the corners of the towel until the skin is well reddened. Of course, if such bath is taken in a bathing establishment, this manipulation is done by an attendant, but the special advantage of this treatment is that it can be carried out without aid on rising. The process should not last more than five minutes, and then the body should be well dried with a Turkish towel or so-called elephant mit. The theoretical advantage of this treatment is the engorgement of the surface blood vessels and the consequent abstraction of the blood from the visceral ones; hence it is particularly applicable in catarrhal conditions of the stomach and intestines. In my personal experience it has proven especially valuable as a substitute for the plunge, which is preferable, but will not be employed by many patients in that great class called neurotics, with a marked leaning toward digestive discomfort, like pressure after eating and a feeling of weariness and overdistention of the abdomen by gas in the morning. Of course, one has to combat the preconceived notions of the patient as to taking cold, too much shock to the nervous system, etc., but ordinarily, with a little persuasion, except in the most confirmed hydrophobies, the treatment will be carried out faithfully. When, however, the patient complains of much lassitude after the cold rub, and declares that it takes two hours and more to get warm in spite of the brisk rubbing, it must be

temporarily foregone, but should be resumed as soon as increased nutrition has improved blood conditions, for those who make such complaints are either so sluggish that any surprise like the shock of cold water is distasteful to them, or else are really anemic and reaction does not promptly take place.

2. The needle spray is another means of application of water, in which the temperature of the water should alternate between hot and cold, but should end in cold. In all bath establishments and dressing rooms of gymnasia, as well as in most of the homes of the rich, this apparatus is installed, but its particular value is its application immediately on rising, and here such institutions are of no avail. Fortunately, a spray apparatus has been devised and is sold at small cost which can be applied by a divided hose and two rubber nipples to any bath tub, thus giving the poor all the advantages of the rich in this respect. This spray should be applied particularly to the abdomen for three to five minutes, and its action is that of a thermic massage. To me it has proved most valuable in atonies of the stomach without pyloric narrowing, and unquestionably, by inducing later stronger and more prolonged peristaltic action, causes the organ to be emptied more promptly. It also induces peristaltic action in the intestine and often a desire for stool.

3. The plunge naturally follows the cold rub after the latter is practiced for a short time, and consists in filling the tub with water from the cold faucet, either at the time of rising or, in case of the particularly timid, the night before, whereby the water assumes the temperature of the room, and then wetting the whole body by rolling over two or three times in the cold water, after which the patient wraps himself in a warm bath towel and waits for the reaction, which comes almost immediately in the form of a glow and sense of well-being, often followed by an appetite for breakfast. This form of bath is particularly indicated in those who awake with a dull head and a feeling of lassitude—as they express it, "as tired as when they went to bed," a "dark-brown taste" in the mouth, and no desire for food. After a sleepless night, too, it is surprising how the plunge will rejuvenate the jaded nerves. Gastric neuroses where no definite departure from the normal laws of secretion and motility are found often yield gracefully to this treatment when all others have failed.

4. The warm sitz-bath, or hip-bath (95°-104°), proves most effective in lowering the acute nervous tension under which many of these victims of nervous dyspepsia suffer, and stops spasm of the pylorus or intestine, either of central origin or due to a local ulcer or its scar.

Many an incurable malignant disease can be relieved of its sting for the night by placing the patient in a hot hip-bath for five minutes before retiring, for at least a part of all pain in these cases is due to spasm of a portion of the organ in which the growth is situated. Then, again, the painful sensations accompanying membranous or mucous colitis, as you choose to call it, and of cholecystitis, particularly in the latter, if accompanied by the needle spray, can be allayed by the hot hip-bath. Of course this does not imply that real gallstone colic can be relieved by any such means, but in conjunction with sedatives it helps, and during an attack the bath tub is the best place for the victim. Furthermore, this form of bath before retiring has enabled me to defer, and often avoid, the use of hypnotics in that twin sister of nervous dyspepsia, insomnia, unaccompanied by pain, but associated with a most active mind and great restlessness. My experience with the cold hip-bath is nil, for the application of cold in any form, in my mind, must be accompanied by action to resist its possible injurious effect, and to remain thirty minutes, as recommended by some, sitting in cold water (unless there is temperature of fever present) seems rather barbarous.

5. Cold applications, made by wringing out a towel of cold water, wrapping it about the abdomen, and covering with a dry one, both to be fastened with a safety pin, until the former is warmed and dried by the heat of the body, causes theoretically a contraction of the blood vessels and stimulation of the peripheral nerves. Actually it is often the needed stimulus for the after-breakfast defecation, and is especially indicated in women who have borne many children, have lax abdominal walls and moderate prolapse of the abdominal organs. It is often well to repeat the application once during the morning period before dressing, while attending to the innumerable things associated with a lady's toilet. Others prefer to make the application at night, and many times fall asleep with the cold pack around their abdomens, and, "post hoc ergo propter hoc," declare it the sovereign remedy for insomnia. Hot packs can be applied after the manner of our forefathers—by flaxseed poultices or by several thicknesses of flannel wrung out of hot water, which, of course, must be changed every five to ten minutes; by the hot water bag or thermophore, which is now made in shapes to fit the contour of the abdomen closely, and will retain water at any temperature for a long period of time; or by the electric pad where a current is available, which by means of a switch can be maintained at different degrees of temperature, but is very expensive, both as regards the instrument and the amount of current

used. When moist heat is employed, it is well to apply vaseline to the patient's abdomen, to prevent, if possible, any superficial burns, and a clotheswringer will be fully appreciated by the nurse who has to wring out the hot cloths. The thermophores are chiefly objectionable on account of their weight, particularly when applied to the abdomen, but this has been overcome largely by employing wood alcohol, which will retain its heat for hours in such an instrument. It is needless to say that alcohol must always be warmed by dipping its container in hot water. The effect of these hot packs, whether dry or moist, is to quiet pain and produce a hyperemia of the organs lying under the skin and a better circulation through them. Therefore we use them for gastroduodenal ulcer where no hemorrhage has occurred within a week, for appendicitis, intestinal catarrh associated with diarrhea and periodic colic-like spasms, and sometimes for constipation due to spasm. Whenever bleeding is present anywhere in the tract, the hot pack is contraindicated, and the cold application wins its own, either applied as an ice bag or, again, the thermophore filled with ice water. These cold applications are also desirable where there is active inflammation associated with pain, tenderness, and heat.

Mineral Waters.—Mineral waters have had their vogue in the treatment of digestive disorders, but, as each water has induced the erection of a sanitarium at the site of the spring from which it comes, where more attention is always paid to the amount of water consumed than to diet and exercise, these waters have never accomplished what they should. There has always been a certain air of mysticism associated with mineral water drinking, as if they could accomplish vastly more at the spring than similar waters compounded accurately after the chemical formula of the former.

The action of mineral waters on digestive disorders depends on the temperature, the amount taken, its content in carbon dioxide, and the amount of the dissolved salt which is absorbed. (1) Both hot and cold mineral waters increase peristalsis of the entire tract as well as its secretion, but do not increase the flow of bile. (2) The carbon dioxide increases the blood pressure, produces diuresis, and has a mild anesthetic action on the stomach, but does not in any way increase the secretions. (3) The action of the dissolved salts (sodium and potassium chloride; sodium, magnesium, and calcium carbonate; magnesium and sodium sulphate; iron and arsenic compounds) depends largely on the concentration; if greater than that of the blood, mineral waters remain a much larger time in the stomach and cause a flow of fluid from the blood to the tract, thereby

producing fluid evacuations. Whether the radioactivity of the waters has any influence is difficult to say. Bickel and others thought pepsin was increased, but the waters must be drunk at the spring, for the radioactivity of mineral water disappears forty-eight hours after its removal from its source. There is still in the medical profession a certain amount of superstitious awe concerning radium, which, apart from quantities large enough to actually produce burns, is much as faith is described, "the substance of things hoped for, the evidence of things not seen." Hence we shall confine ourselves strictly to those waters which have a clearly defined action and may be employed therapeutically to combat certain circumscribed pathological conditions, and these are very limited in number:

1. *Mild alkaline waters*, which contain sodium bicarbonate and carbon dioxide, like Vichy (Celestins), which has 5.1 parts per 1,000 of the salt and 532 parts of free carbon dioxide; Saratoga Vichy, which has 2.2 parts of the salt per 1,000 and 1824 parts of carbon dioxide. Thus we see that the imported water has more sodium carbonate, but much less carbon dioxide. Then, the artificial Vichy of the soda fountain or as sold in siphons, if made of pure materials, has practically the same solution. In the Newer Formulary we also have Sal Vichyanum Factitium, which, when 1 gram is added to a glass (200 c.c.) of water, produces a similar effect. The use of these waters is confined to mild gastric hypersecretions, as it neutralizes the acid without in any way increasing such secretion. Their power to dissolve mucus or stimulate the flow of bile, as claimed, has never been demonstrated.

2. The *alkaline laxative waters* contain sodium sulphate and chloride, sodium carbonate, and free carbon dioxide. The ones in common use are the Carlsbad (Sprudel), which at the spring has a temperature of 144.8° F., so that elsewhere, when the imported article is used, it is usually heated to that point before it is taken. Our best substitute for the foreign article is Bedford Springs water, which has, however, only 10 parts of magnesium sulphate, and the former 10 parts of sodium phosphate, while the Carlsbad has much more sodium carbonate. We have, however, the evaporated salts from the genuine Sprudel water, which, unfortunately, are now being freely advertised to the public in the newspapers, and also Sal Carolinum Factitium, N. F., which, in my experience, gives just as good results, when a gram is dissolved in a cup of hot water, as either the imported water or the salt. Yet, to those who can afford it a stay either at Bedford Springs, Pa., or Carlsbad is to be recommended for the change and regimen

carried out at both places. Just what the physiological effect of these waters on digestion is has never been fully demonstrated. Some claim diminution of gastric secretion, while others fail to find it; many claim an increase of motility, while others again could not demonstrate it. Therefore, the miraculous effects of the treatment of gastric disorders at Carlsbad by the waters alone have fallen into disrepute, but we are willing to give the physicians there credit for relieving many patients of their functional digestive disorders, and perhaps some organic, by methods of which probably drinking the water plays but a minor part. After personal observation of the treatment at Homburg, with its saline, sulphur, and iron springs, it appeared to me that the regular life, restricted diet, exercise, beautiful music, and mountain air had as much to do with the improvement as the vaunted water drinking. We can, however, send only a small percentage of our patients to the springs, so, as in the case of Mahomet and the mountain, though reversed, the springs must come to us, and, laying aside any veneration for the spring water not based on its chemical analysis, we must prescribe it only in conjunction with diet, exercise, amusement, and regular life, when we shall obtain the results our Carlsbad brethren do. When the Carlsbad treatment is given at home, it is very necessary, too, that the exact time when the water is to be taken should be specified, as well as its amount and temperature. Usually it is best to give two glasses, fasting, about twenty minutes apart, and half an hour after the last glass breakfast is to be taken. The patient may remain quiet or move about during the drinking, though at the springs exercise is recommended. For dispensary practice, where economy is an object, the artificial Carlsbad will accomplish the same results as the imported mineral water, apart from the adjuvant means employed with drinking at the springs. Now the Carlsbad treatment is indicated (1) in all cases where there is hypersecretion of gastric juice; (2) in all chronic gastric and duodenal ulcers; (3) in chronic catarrh of the small intestine, in small doses and very hot; (4) in the diarrhea following chronic dyspepsia; (5) in chronic atonic constipation, given cold. On the contrary, we should not employ it (1) in acute diseases of the tract (bleeding ulcer of the stomach or duodenum, acute enteritis, or appendicitis); (2) in dilated stomach due to benign or malignant pyloric obstruction; (3) in gastrointestinal neurosis; (4) in achylia gastrica; (5) in any malignant disease of the intestine. Those suffering from nervous dyspepsia, who form at least 75 per cent of one's practice, are particularly unsuited to the Carlsbad treatment, and are invariably made worse if it

is attempted, so that it can be readily seen that one must be excessively careful in the selection and that comparatively few "are chosen."

3. *Saline waters* contain chiefly sodium chloride and carbon dioxide. The Kissingen springs are the most popular abroad, and we have approved the treatment so much that we have introduced into the "Newer Formulary" Sal Kissingense Factitium, from which the mineral water can be readily made by adding a gram to a cup of water (Rakoczi Spring). The Congress Spring at Saratoga Springs, New York, furnishes water of the same general composition. The action of this water is based on no scientific facts, but seems to be used empirically. It dissolves mucus in the stomach, stimulates appetite, and increases the secretion of hydrochloric acid. The free chlorine ions in the interior of the organ provide the chief basis for the existence of hydrochloric acid, and the strong saline waters, by producing a flow of the diluting fluid from the blood to the interior of the stomach, diminish the acidity of the latter's contents, and because not reabsorbed they produce fluid evacuations. The chief indications for the use of this water are anacid gastric catarrh and achylia gastrica, which is so commonly of nervous origin. It is claimed that a return of hydrochloric acid often follows the use of Kissingen or Congress water, but my testimony cannot be added to that, pro or con, for, when that fortunate event has happened to me with patients, drinking the waters has been only a part of the treatment. Of course this applies only to the functional forms of achylia. Actual experiment with dogs gastrostomized by Pawlow's method shows that with these saline waters gastric secretion is increased 74 per cent beyond what it is with ordinary water. As stated, in large doses the waters produce free movements, and hence are indicated for colon catarrh associated with constipation. These waters should never be used in case of gastric ulcer, nervous dyspepsia, atony, and dilatation of the stomach, or in any form of cancer of the tract.

4. *Bitter waters* are those containing sodium sulphate and chloride, and magnesium sulphate. They are represented chiefly by Hunyadi Janos and Apenta abroad, and Red Raven and Pluto water from French Lick Springs, Indiana, in this country, though the claim has been made by the Council on Pharmacy and Chemistry of the American Medical Association that the last-named is fortified by the addition of magnesium sulphate.

These purgative waters are not absorbed, but pass to the lower intestinal tract, where they absorb water from the blood on account of their higher osmotic index and stimulate peristalsis, as a result of

which they promptly produce a liquid stool soon after taken. At the springs they are always cold, and should be taken that way apart from the springs; hence their use is confined to an occasional morning dose before breakfast for producing a loose stool when hemorrhoids are present, or after a too hearty meal the evening before, or for the purpose of driving out tapeworm. On the contrary, these waters should never be used in any acute inflammation of the tract, whether of the stomach (ulcer) or of the intestine (appendicitis). The amount should not exceed one glass.

The iron spring waters, though recommended for the anemia associated with chronic ulcer, achylia gastrica, etc., have never proven of any benefit in my practice. Levico, an arsenical water, however, has apparently in these conditions been able, with the aid of iron-containing food (or possibly the latter alone), to restore the hemoglobin to its normal percentage much sooner than without its use.

Climatic Influences.—Climatic influences often play an important part in the relief of those forms of indigestion which have a large nervous element associated. Whether the change of climate should be to the mountains or shore seems much a matter of indifference, so long as luxury and strain are exchanged for "roughing it," as we call camping, and freedom from care. Astounding as it may seem, food which an individual with impaired digestion would look on with horror at home is eaten with relish in a camp at the ocean side or in the mountains, and digested without discomfort. The frying pan is used without discretion and self-rising flours (which never rise) cause no complaint. This immunity in camp is, however, confined to the nervous dyspeptic, as he is called, a product largely of our American rush, and does not justify any such risk with the person suffering from a chronic gastroduodenal ulcer. The seashore, too, has won well-merited renown for the relief of these same dyspeptics, particularly where the daily dip in the ocean may be indulged in. This does not apply, however, to the palatial hotels at the seaside where life, if anything, proceeds at a faster pace than at home, and where excessive eating, dancing, and long hours spent sitting on a piazza in a lethargic mood, digesting like a saurian the excess of food which has been previously swallowed, do not aid in any way to overcome the difficulty for which the patient was sent to the seashore. Better a crust in the open than a Lucullus feast under a roof. The seashore offers greater atmospheric pressure, freedom from dust, moisture, and an increased content of the air in salts as well as ozone, all of which, with the bath, offer a tonic which proves most advantageous for anemia associated

with functional dyspepsia, as well as for nervous diarrhea, which is especially benefited by a stay at the seashore. Certain restrictions must be impressed on patients with reference to bathing in the ocean in order to obtain the greatest therapeutic effects and not to cause harm. One should never take a bath at once on arrival, but had best wait two or three days before beginning. One should not bathe early while fasting, and should not remain longer in the water than ten minutes, though this does not exclude the custom of a sun bath in the sands and a return to the water afterward. The best time is at flood tide, and for very feeble persons the salt water should be warmed, as is customary in most bathing resorts. Under the influence of these salt baths the appetite is usually aroused to its utmost, and patients must be warned against too early complete gratification. It is much better to indulge in the 11 A. M. and 4 P. M. lunch than to eat at the three regular meals all one cares for. The sea baths are, on the other hand, contraindicated where the patient suffers from arteriosclerosis, any disease accompanied by fever, acute gastrointestinal catarrh, and cholelithiasis. On our own Atlantic coast Atlantic City, Fortress Monroe, and Palm Beach have won great renown for winter and autumn resorts, while Old Orchard, Newport, Nantucket, and Bar Harbor have become famous for summer resorts, but, as far as that is concerned, the whole of New England is studded with small resorts and islands, and the purse must be slim indeed which will not allow its possessor a short stay at one of these places. Why speak of the inferiority of the accommodations at these places to those of one's home? It is a change and a rest, and the crudeness of the surroundings too often adds only zest to the enjoyment. It is the bitter experience of many a physician to have recommended a residence at some resort to an individual and to be compelled to listen to reproaches because the accommodations were not such as the patient had at home. Much the same is true of the mountain resorts. The patient is often benefited by the air and life in the open, but, unless he be of the type mentioned and possess no actual organic disease, he had best be sent to a sanitarium, where proper food and cooking can be acquired, as a chronic ulcer of the tract, an early and undiagnosed cancer (as many are), or a chronic enteritis will not show any improvement on the products of the frying pan. My experience, however, limited to Poland Springs House and Woodstock Inn, places kept open all winter, is that a diet sent with the patient will be fairly closely followed by the chef. This course seems much better than to send those in whom the digestive organs are at fault to sanitariums where neurasthenia is

chiefly treated, and where they have notions of their own in regard to diet and your own receive scant attention. Then, further, at both winter and summer resorts at the seashore or in the mountains your patients are surrounded by cheerful individuals, bent on sport, which is encouraged in every way, instead, as at a sanitarium, of long-faced, whining persons, who congregate only to compare their symptoms and weigh their importance, and, much as at a temperance meeting where the one who can tell of the worst degradation is looked on with awe by his neighbors, the patients who have lost most organs by surgery or been nearest death are venerated by the group. Sanitariums are only for the most hardened criminals in breaking the laws of health, while an ocean or mountain resort, with possibly a nurse to see that your instructions are carried out, is much better fitted for the majority of patients with digestive disorders. But what shall we do with the poor who cannot afford the luxury of these resorts? Well, in our section of the country they have answered that for themselves, and many a shack or discarded car from the old horse railroad days perched along the shore contains a family in whose number is one or more weaklings, who, coddled with condensed milk and the various artificial foods in the tenements of the city, are able to devour their hot biscuits and bacon with impunity. Nor is only this section blessed in this way. Anyone entering the cities or Berlin or Vienna will be struck by the small shacks, many of them beautified by climbing flowers, and the small piece of cultivated land, occupied by the city dwellers who often have only Sundays to acquire health, yet possess a sound digestion and sounder sleep. This same movement, introduced by Mayor Pingree of Detroit, should be imitated by every municipality. Call it change of climate, which it can hardly be, since only ten miles separate the shack from the tenement home; call it change of surroundings or the out-of-doors occupation—many a functional dyspeptic has been restored to health by it when the formulary of every clinic has been exhausted.

Massage.—Massage is also employed advantageously in digestive diseases, both as general massage and that particularly applied to the abdomen. The first action of this method of treatment, both during and after it, is on the metabolism, by which, as a result of the increased circulation of the blood, more nitrogenous waste is eliminated and absorption becomes more active. Many are skeptical of this method of treatment because, though the intestine may be readily reached by the masseur's hands, the stomach lies largely under the ribs and the liver. But this is only under normal conditions; in pro-

lapse of the stomach the organ is wholly exposed to the hands, and here massage accomplishes its greatest victory, for the abdominal walls are usually lax and the stomach atonic. The most common indication for abdominal massage is atony of the stomach and colon, accompanied by infrequent stools. Furthermore, in conjunction with this method of treatment, all other methods must be employed, for it is no cure-all. In addition, the patient must be willing to have this treatment continued for months, for a four weeks' treatment is worse than useless. Massage is contraindicated (1) soon after a gastric hemorrhage, or when occult blood is freely present in the stool; (2) in all forms of malignant disease of the tract, particularly when accompanied by stenoses; (3) any attack of appendicitis, if the appendix was not removed, precludes the use of abdominal massage for years after the attack (Zweig). It has never been my practice to massage my patients, as is recommended by many, since in both private practice and in all clinics we have admirably trained practitioners of this art, mostly trained in Sweden. Still, each physician should have enough knowledge of the subject to intelligently direct the masseur what to do, and Bum's description and illustrations make the matter clear.

The abdominal massage is best carried out three hours after a meal and with an empty bladder. The patient lies, with the upper half of his body slightly raised, on a hard surface, and the practitioner sits at his right. The technic consists chiefly in kneading the abdominal walls and the intestinal parts adjacent, for all we can hope to accomplish is the restoration of tone to abdominal muscles and the flat muscles of the tract.

The first sitting should be devoted to accustoming the patient to the relaxation of the reflex abdominal muscle contraction under the massaging hand, a feat best accomplished by laying the hand flat on the abdomen in the region of the navel, and making circular motions to the right with the finger tips, directed against the right floating ribs of the patient (Fig. 50).

With moderate pressure, as the hand turns on the wrist as an axis, the hand is contracted until, when the motion is completed, the fingers point toward the left inguinal region of the patient (Fig. 51).

Now the abdomen should be kneaded in both a horizontal and vertical direction with both hands, grasping portions between the thumb and finger tips, and also between the base of the hand and all the fingers, including the thumb, endeavoring always to reach as deeply as possible (Fig. 52).

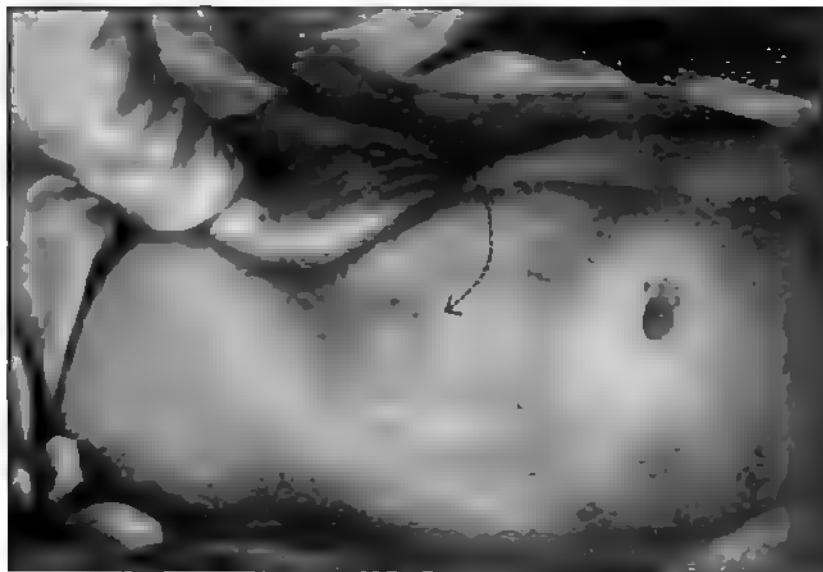


Fig. 50.—Abdominal massage, first manipulation.



Fig. 51.—Abdominal massage, second manipulation.



Fig. 52.—Abdominal massage, third manipulation.



Fig. 53.—Abdominal massage, fourth manipulation.



Fig. 54.—Abdominal massage, fifth manipulation.



Fig. 55.—Abdominal massage, sixth manipulation.



Fig. 56.—Abdominal massage, seventh manipulation.



Fig. 57.—Abdominal massage, eighth manipulation.

We now proceed to the massage of the colon, which is accomplished by pressing the first, second, and third fingers of the left hand upon the abdomen as deeply as possible with the free hand, and, with the pressure maintained, make boring motions, always getting deeper and deeper, trying to compress the colon between the abdominal wall and the posterior wall of the pelvis. These motions should be intermittent, and, beginning in the ileocecal region, those parts should be chosen



Fig. 58.—Abdominal massage, ninth manipulation.

for this kneading process where feces are liable to accumulate—viz., ascending colon and hepatic and splenic flexures (Fig. 53).

Now along the whole length of the colon stationary kneading follows progressively one after another (Fig. 54).

Now follows a series of gliding strokes over the colon, with one hand still over the other to exert greater pressure, and always in the direction of the course of the feces (Figs. 55 and 56).

This should be followed by shaking the abdominal wall, as in eliciting succussion, by vertical cautious strokes with the finger tips or lightly closed fist (Fig. 57).

We complete the process by compressing the abdomen with light blows from the finger tips of each hand alternately (Fig. 58).

All these motions should be carried out lightly, and the patient should never experience pain from them, or more mischief than good may be done, even if no actual danger accompanies. Furthermore, as



Fig. 59.—Portable electric vibrator.

such motions may be made almost limitless in scope, each practitioner soon learns to devise new motions which are better suited to his needs. It is usual in digestive disorders to massage the whole abdomen. There are, however, certain diseases of the stomach *per se*—such as atony, gastroparesis, gastrectasis, and nervous dyspepsia—where massage should be confined to the stomach region alone. In this case the organ must not be empty, nor should it be fully distended, two to three hours after the last meal being the best time. Of course, when the organ lies in its normal position under the ribs of the left side,

massage cannot reach it, but, apart from a few cases of gastric neurosis, where there is no displacement and where the employment of massage is useless, the organ is usually under the manipulator's hands, at least in part, in these conditions. The motions of stroking, kneading, and shaking should be carried out as in the case of the lower abdomen,

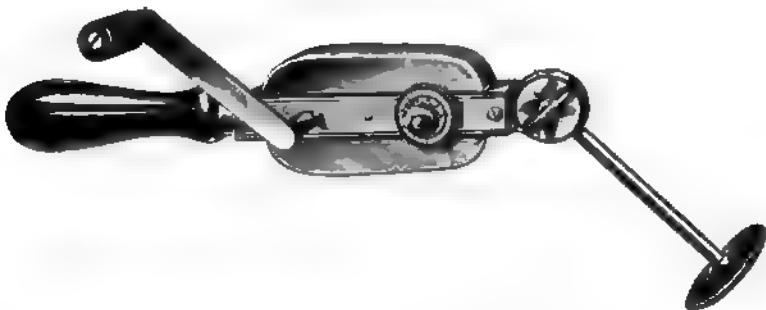


Fig. 60.—Crank vibrator, with pulsating cushion.

but more gently. Where individuals cannot obtain massage easily, as during departure from the city in summer or from lack of means, the mechanical vibrators, sold at drug stores and instrument houses, are very satisfactory. They are of two kinds, one which can be readily attached to an electric light socket, and the other an instrument which is driven by a crank.

Electrical Treatment.—The electrical treatment of digestive disorders maintains its popularity, though no actual scientific evidence exists for its action on the digestive tract. We use either the galvanic or faradic current, and apply it either cutaneously or internally, or use a combination of both; in the last case, a broad electrode is placed over the abdomen and electrodes are introduced either into the stomach or the rectum. By different authors it has been claimed, and denied by experiments on animals and humans, that electric current increases both secretion and motility—clearly a case of “Donny did and Donny didn't”—while later enthusiasts, like Riegel, Boas, and Einhorn, claim neither increase of secretion nor motility, but speak of its general beneficial effect on the nerves and muscles of the stomach, implying apparently that it takes the nerve out of nervous dyspepsia, for the prolapse or the atony nevertheless remains. Whatever may be said of its inability to perform actual work in increasing motility or secretion, many derive some benefit from it, and, as the gastric neurosis is so intractable, we are entitled to any means for its subjection, even if the means is a species of suggestive therapeutics.

There are two ways, as stated, of applying electricity for these cases—extragastric and intragastric. For the former a large well-padded and moistened electrode should be applied to the upper abdomen from pylorus to fundus, and another, separated from the former by a space of 1-2 cm., from the fundus to the vertebral column. The current, which is most satisfactory when derived from the incandescent light current and reduced to medical needs by the rheostat, should be used in considerable strength—the galvanic, 10-20 milliamperes, and the faradic, or interrupted, strong enough to cause smart contractions of the abdominal muscles. The application should be continued from five to ten minutes, and, if the galvanic current is used, particular care must be taken that no bare metal of the electrode comes in contact with the skin, for it has been my experience to produce mild burns even with this very low amperage when such precautions have been neglected. A combination of electricity and massage can be employed to advantage by laying a plate electrode over the sternum and as a second electrode using an electric roller, which with moderate

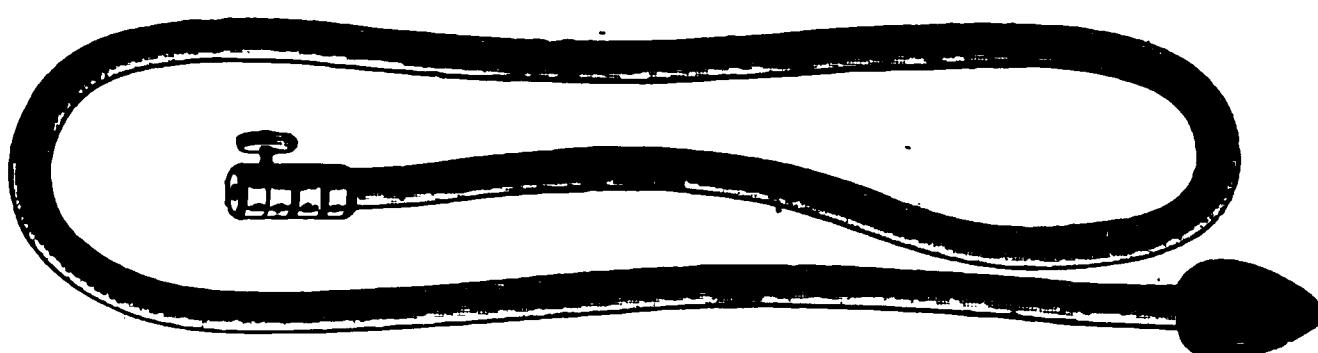


Fig. 61.—Intragastric electrode.

pressure is passed from the fundus to the pylorus several times. As there is still some question whether the effect of electricity on digestive disorders is not a species of suggestive therapeutics, my choice is always the faradic current, because the noisy interruption of the induced current appeals also to the ear, and, as many a patient has remarked, seems as if it "were actually doing something."

Intragastric Electricity.—Intragastric electricity may be applied by several methods which have been devised. Almost every manufacturer of electric apparatus lists a sound more or less modified from Bardet's or Boas', which, after the patient has swallowed a glass of water to prevent burning, may be inserted and the current turned on.

Einhorn modified this method by devising a metal button, covered with a hard rubber shell, perforated with small holes, and allowed the metal to communicate with the fluid in the stomach; in turn the button was connected by a fine well-insulated wire with the source of electrical energy; after drinking a glass of water the electrode was to

be swallowed, the pad was to be placed over the stomach, the negative wire attached to the former, and the current turned on.

Wegele has also devised an electrode, which has the advantage that it may be introduced into any stomach tube, consisting of a metal wire, a guard which can be moved up and down the wire and clamped in position, having also an orifice for the insertion of the current wire and a second clamp, and at the end a metal button. First, this wire is to be inserted into the stomach tube and the guard adjusted so that the button shall be 1 cm. above the first opening of the Jacques tube and clamped to the wire. Then it is to be withdrawn, the soft rubber tube inserted into the stomach (the latter washed out if necessary), a small quantity in any event poured into the stomach, when the adjusted wire is now introduced into the tube, the connecting wire (negative) attached, the other wire connected with a large flat electrode over the abdomen, and the current started.

Einhorn recommends an eight-minute duration of treatment and the galvanic current of a strength of 15-20 milliamperes, but patients have

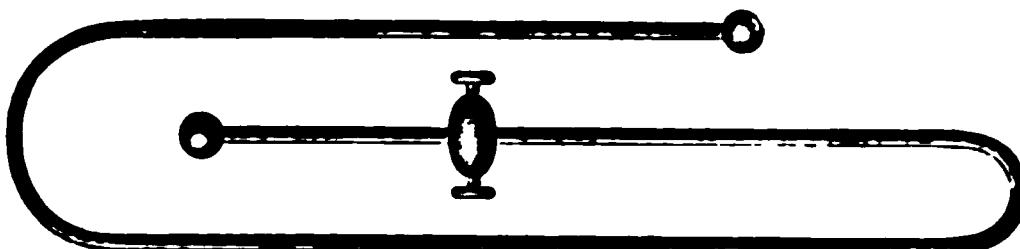


Fig. 62.—Wegele's intragastric electrode.

often complained to me of a current stronger than 10 milliamperes. As to electrodes, Einhorn's is difficult to swallow, the stiffer ones after Bardet's model uncomfortable to retain in the esophagus for eight to ten minutes, while the most convenient of all is Wegele's which is rarely listed by our instrument makers. The intragastric application has largely been given up by me, except faradism for relaxed cardia, where the gastric contents come tumbling out around the tube instead of through it, and where the patient complains of heartburn with a normal or lessened hydrochloric acid and no fermentation. The cutaneous application, however, deserves much more general application in gastric neuroses, call its effects what one will, but has been brought into disrepute by the so-called electric specialists, who have employed it for every form of gastric disease and, naturally, without effect in many. For gastric atony and gastrophtosis without pyloric stenoses it may be tried, but never to the exclusion of other means of treatment, and my faith in its efficacy is like the grain of mustard seed. The general principle in the use of electricity in gas-

tric disorders is faradism for motor disturbances and galvanism for sensory anomalies, *gastralalgia*, etc., and for hypersecretion.

Many intestinal disorders, too, may be benefited by electricity, perhaps to a greater extent than gastric, though, as before, scientists leave us in confusion as to the real physiological action, if any takes place, at least with an atonic colon and constipation. Triumphs and failures have been mine, but, while employing electricity in such cases, it has never been my custom to lose sight of other means of accomplishing my purpose. A similar rectal electrode has been devised by Zweig, which has the double advantage that a lumen for fluids remains open, controlled by a cock, so that fluid like water or salt solution may be poured into the rectum, the cock closed, and a faradic current passed through the contained spiral wire by means of a clamp, to which the negative wire of the electrical supply should be applied.

For the abdomen the massaging roll is best adapted, which should follow the course of the colon. Muscular contractions are set



Fig. 63.—Zweig's rectal electrode.

up freely in the abdominal muscles, and the sphincter ani is found spasmically contracted about the electrode, which, after a sitting, is often withdrawn with difficulty; in fact, one of my unpleasant experiences was to have the electrode (which was not new) separate on account of the tension and one portion remain in the rectum. Of course the accident was speedily remedied, but it proves the sphincter contraction. No permanent relief of functional constipation—and by that is meant what is due to an atonic colon—can be expected unless the electrical treatment is continued for weeks, but most individuals will state that peristalsis as recognized by borborygmi—is set up soon after each treatment, and often some haste for a lavatory for the subsequent imperative defecation is demanded. With the Zweig electrode the galvanic current cannot be applied on account of its metal tip, which may burn the mucous membrane, but, as faradism is the only current which can apparently arouse the sluggish gut to activity, this defect is not felt. The cutaneous application of electricity, particularly of galvanism, to the abdomen proves useful in colicky at-

tacks when not associated with stenosis, flatulence, and tormina intestinorum. One electrode (positive) should be placed over the sternum and the broad cathode over the abdomen. The cutaneous use of faradism for constipation has not merits.

Washing out the stomach has been mentioned in Chapter V as a means of detecting stasis after an evening Riegel meal. Here we wish to consider the therapeutic value of the process, introduced first by



Fig. 64.—Gastric lavage, introduction of the tube with head bowed.

Kussmaul in 1867, as a relief for the evils of pyloric stenosis. Probably no method of treatment has, however, been so abused as this. There is hardly a gastric disease, functional or organic, for which Penzoldt in his work on therapy does not recommend gastric washing. Therapy in his hands is restricted more closely than in those of the otologists, who, as the late Dr. Richardson used to say, washed out one ear and blew up the other. At present this method of treatment is applicable only when food remnants (stasis), or gastric juice

(continuous secretion), or much mucus (gastritis) is found in the fasting stomach. All tales of spraying the stomach through a tube with centipede-like openings, or the use of the gyromele, by which you can brush your stomach as you would your teeth, never appealed to me as having any other effect than a sensation of comfort on the part of the practitioner that he was doing something. If the stomach, when empty, remained like a gold fish globe, spraying and brushing would



Fig. 63. Gastric lavage, filling the funnel.

be feasible, but, as it collapses as the food leaves it, much as a hot water bottle when water is removed, its toilet must be left to nature. In washing out the stomach not over 500 c.c. should be introduced at a time, which must be returned before any more is poured in; the water should be tepid, and may have a tablespoonful of liquor antisepticus alkalinus, N. F. added to a liter of it; the funnel should be lowered each time when the water is poured in and then raised, but never allowed to completely empty before a new portion is added,

so that air may not be driven in. The stomach should be washed until the water flows out clear, with the exception of bile, which is usually mixed with it, and the tube should be withdrawn before the water has entirely ceased to flow, so that a bit of gastric mucous membrane may not be drawn into the eye of the tube and torn off. Apart from the purely gastric disorders mentioned, to which we may also add the less common acute dilatation for which gastric lavage is indicated,



Fig. 60. Gastric lavage along the stomach by gravity.

we have intestinal stenosis or ileus accompanied by fecal vomiting, which is often vastly benefited by the same process, which removes fecal matter and gases above the narrowed portion, lessening peristalsis and rigidity with the cessation of vomiting. Uremic vomiting also may sometimes be allayed better by lavage than by any other means. Contraindications to lavage are the same as those to the introduction of the tube mentioned in Chapter V. It sometimes happens that, owing to the great atony of the stomach, the water does not

return promptly. If one is convinced that this is not due to an occlusion of the tube by some fragment of food, which can be easily told by pouring another small portion of water into the funnel and noting whether it flows into the stomach, it may be found necessary to place the patient in a recumbent position, when very often the flow will be reestablished, accompanied by food remnants. In an hourglass stomach we may apparently have washed the stomach clean,



Fig. 67.—Gastric lavage, emptying the stomach by siphonage.

when suddenly another mass of food remnants will appear in the wash water, a very significant sign of this condition. Innumerable substances have been suggested as adjuvants to the wash water in the hope of adding a medicinal as well as a mechanical effect to its action. These are sodium bicarbonate, 2-5 per cent, for gastritis; sodium chloride, same amount, for achylia; and Carlsbad salts, silver nitrate (1:1,000), or protargol (0.5 per cent), for hypersecretion; antiseptic substances, thymol ($\frac{1}{2}$ per cent), resorcin (2 per cent),

boric acid (3 per cent), sodium salicylate (1 per cent), and ichthyol (1 per cent) have been added to overcome fermentation in dilatation accompanied by stenosis, but my preference is for liquor antisepticus alkalinus, N. F., as stated, which serves all needs as an alkali and antiseptic, both of which effects must be very slight on account of the short stay of the fluid in the stomach. With the addition of bitter substances our experience is nil. Zweig recommends a tablespoonful of fluid extract of condurango added to 500 c.c. (pint) of warm water, and allows the liquid to remain a minute in the stomach before it is withdrawn.

Rectal injections or clysters are employed for 4 distinct purposes: (1) to empty the lower bowel, (2) for treatment of colon catarrh, (3) for introduction of medicinal agents, (4) maintenance of nutrition.

The evacuation of the lower bowel may be accomplished by water alone, which is best introduced at a temperature of 72° F. (lukewarm) or 64° F., or lower, by means of the fountain syringe through a soft rectal tube, with the patient on the left side. The water must not be used too hot, for powerful reflex contractions are set up and it cannot be retained. The amount should not exceed 500 c.c. (1 pint), and should be retained ten minutes before it is ejected. Ice water injections are very beneficial for hemorrhoids and gastrointestinal hemorrhages, causing reflexly an arterial spasm. The soap and water injection is an old household procedure, but no soap should be employed with too great prodigality, a piece as large as the end of the thumb to a pint of water sufficing; nor should it be of the highly perfumed kind, because in the former case too much alkali is introduced, which acts as an irritant and causes too great contraction, which ejects the water without fecal matter, and in the latter case because nitrobenzol, a virulent poison, is often used for perfuming cheap soaps. The glycerine injection, consisting of 20-25 grams (a tablespoonful), may be introduced by a straight syringe, may be employed as a suppository, which is much more convenient, or may be added to soap and oil. My favorite is a pint of warm water, a piece of soap the size of a walnut, and 2 tablespoonfuls each of glycerine and cotton-seed or castor oil. This fulfills the double purpose of softening the feces and producing vigorous contractions. When, however, patients are suffering from hemorrhoids or anal fissure, the glycerine should not be used. When, as often happens, the water refuses to flow through the rectal tube, the latter should be withdrawn somewhat, which, by straightening it, causes the lumen to be restored and the

water enters quickly. The pure oil injections, introduced by Fleiner, have been used very generally in constipation caused by colon catarrh and in colpoptosis, because, unlike all drastic laxatives, they do not aggravate the catarrh. An outfit consisting of a metal irrigator, because the oil soon destroys rubber, a connecting tube (4 feet in length), and a rectal tube with a glass union, is most desirable. One-half a pint of cottonseed oil (a cupful), warmed to the temperature of the body by setting the cup in warm water, is poured into the irrigator, the rectal tube inserted to the length of about 4 inches, and the oil allowed to flow slowly into the rectum. It is best taken at bed-time in a recumbent position, and sometimes it is necessary to make a preliminary emptying of the rectum with a small water injection, so that the oil may be retained, as it should be, all night; in the morning, either spontaneously, or sometimes with the aid of a small water injection, a copious stool occurs. At times, too, one must confess, the oil simply returns without any fecal matter, but it has been my belief under these circumstances that the rectal tube did not enter the intestine to sufficient length. When effective, the benefit of the oil clyster is soon recognized by patients, who state that their gas pains and distention are benefited, and the stool, instead of being as hard as a stone (as they express it), has become soft. The fear of the patient that the oil will be passed involuntarily during the night is rarely justified, but, for precaution's sake, a napkin or rubber sheet for the bed may be employed. The treatment should be given nightly at first for a week, after which twice a week suffices. Always specify the kind of oil, particularly in clinics where the ignorant congregate. An unguarded direction of mine for any "good oil" brought from the patient loud complaints of burning in the rectum, and inquiries disclosed that any "good oil" had been interpreted by her as meaning mineral machine oil. The indications for the oil treatment are constipation, mucous colitis, peritoneal adhesions, and the attacks of pain accompanying them. Inoperable cancer of the rectum also can be very favorably influenced by this management, and stools induced for a long time when the use of laxatives cause much pain. In cholelithiasis, too, it has seemed to me that benefit has been derived in lessening the severity and frequency of the attacks of pain where operation was inadvisable or refused by the patient.

Perhaps a word or two more in regard to the apparatus may not be amiss. The soft rectal tube should have two side openings, but none in the end, as is common, because the sharp edges of the end opening will sometimes shave off a fragment of mucous membrane, which the

other form (in reality a miniature stomach tube) cannot do. It is useless to attempt to introduce the tube more than 10-15 cm. (4 to 6 inches), because if passed beyond that point it doubles on itself when it reaches the sigmoid and fluid will not flow through it. The "high" colon washings are merely delusions of the practitioner, because it is impossible to pass a soft tube higher, and a hard tube should never be used except under the guidance of the eye (rectoromanscope). Passing the tube beyond this point is not necessary, however, for in the left prone position, with a cushion or pillow under the hips, or even purely horizontal, the fluid will in five minutes reach the cecum, as has been the result of my observation with buttermilk-bismuth carbonate and the fluoroscope. The hard rubber tips should never be used, and piston syringes, except for nutriment or medicinal agents, are entirely uncalled for. A well-worn precaution, but one often neglected, is to open the pinch cock and allow the air in the apparatus to escape before inserting the rectal tube, which at the same time warms the latter. The best lubricant for the tube is not fatty substances, which are difficult to remove, but the various preparations of boroglyceride on the market in convenient collapsible tubes. The amount of fluid employed is best limited to 500 c.c., should be introduced very slowly, and retained as long as possible for evacuation of the lower colon. With persons possessing very lively reflexes it is often well to begin with smaller quantities, a cupful, and then persuade them to increase the quantity, or the rapid defecation will utterly fail to accomplish the purpose for which the injection was intended.

TREATMENT OF INTESTINAL DISEASES.

The treatment of intestinal diseases by means of colon irrigation incidentally carries with it a diagnostic feature, because it is only when mucus, blood, and pus are present in the returning water that such treatment is worthy of continuance. Where the washings are conducted by the physician or the nurse, it is best to use a funnel, which can be raised or lowered, as described in washing out the stomach, and the water in portions of not over 350 c.c. should be allowed to flow in and out until freighted with a goodly supply of the pathological product, when the first portion may be poured into a clean glass for further examination (epithelial cells, pus, etc.); then the washing should be continued until the fluid remains clear. Under normal conditions the first water flows out clear or with small fecal fragments. On account of the difficulty in cleaning rubber tubes, the

possible entrance of air, and the danger of infection, double-current glass tubes have been devised, which are so inexpensive that one can be used for each patient. It is never advisable, however, to let the patient have one to use himself for fear of breaking it by his awkwardness. Such a one as devised by Zweig is shown in Fig. 68, but it does not differ any from various others found in the catalogues of instrument makers. When it is desirable for the patient to use such an apparatus himself, it should always be made of rubber, and should, of course, be attached to a fountain syringe, or some other reservoir, instead of the funnel. The patient, on his left side, has the well-lubricated rectal tube introduced, with the outlet connected to a short piece of rubber tube, which directs the outflow of water into a basin or pail, while the practitioner pours a half liter of

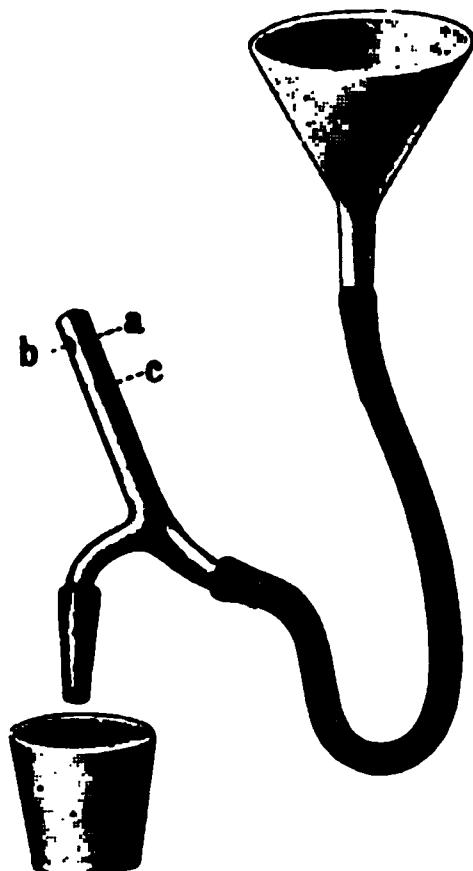


Fig. 68.—Double current rectal tube. *a.* and *b.*, ingress; *c.* exit of fluid.

water into the funnel; or, if the patient takes the treatment himself, the bag or reservoir may be filled and the flow regulated by pinching the tube, and the patient may be seated over the receptacle. In this way 3 or 4 liters of water may be passed through the rectum, washing out mucus, fecal particles, etc., without any harm from the glass rectal tube if carefully handled. If it is desirable to have the water pass higher and wash out the sigmoid, we have only to put a clamp on the outlet tube, and after a considerable amount has flowed in we simply open the cock and let the water gush out. This, too, is preferable when medicaments are added to the water; the latter may be employed for antiseptic purposes or to dissolve mucus. The best antiseptic material is boric acid, sodium salicylate, or thymol, in pro-

portion of a teaspoonful to a quart of water, while for the solution of mucus one can add Carlsbad salts, lime water, sodium bicarbonate, or acetate—a dessertspoonful to a liter (quart).

CONTINUOUS IRRIGATION.

Continuous irrigation of the colon has been adopted by surgeons after operations where much blood has been lost or shock intervenes, as well as by physicians where there is great loss of fluid by vomiting or blood by rupture or erosion of arteries. A physiologic sodium chloride solution (7:1,000) is employed, which is allowed to drop from the reservoir, regulated by a clamp, which contains a screw to control the pressure. Ordinarily a bulb, with a fine tube entering from the top, is interposed, so that one can see at a glance whether fluid is entering and how rapidly.

NUTRIENT ENEMATA.

Nutrient enemata are demanded usually by some disease of the digestive tract. Among those gastric diseases where they are most stringently demanded are stenoses of the cardia and pylorus, ulcer, nervous vomiting, and gastric crises. By this method of feeding we accomplish one of two purposes—either maintain life when food cannot enter or leave the stomach and starvation threatens, or we spare the diseased organ until healing has taken place. Especially is this method valuable in chronic recurring ulcer, for the pain and vomiting usually cease as soon as the patient is placed in bed and fed by rectum for a week or ten days, when return to feeding by the mouth may be attempted. After a sharp hemorrhage from the stomach, rectal feeding must continue five days at least before resort to feeding by the mouth is attempted. Often, when pyloric stenosis of benign character exists, the patient can be fed with great advantage for eight to ten days, by which the gastric fermentation and distention cease for want of material, the thirst diminishes, the urine is increased, and often an accession of weight may be attained as a result of the decreasing dilatation. On the contrary, when an operable cancer of the tract exists, rectal feeding should never be employed in the vain hope of improving the condition of the patient for operation. Those fed by rectum are always undernourished, and this fact, together with the wasting, characteristic of the disease, makes a problem of the time of restoration to an operable condition. Operate at once, and even then, sad to relate, we have often outstayed the “ac-

cepted time." When it has been decided that the cancer is inoperable, then we may employ our nutrient enema—not particularly with the intention of prolonging life, for the condition of the patient is so miserable that this is not to be hoped for, but as a species of euthanasia, because the sense of hunger is somewhat dulled. Just as in nourishment per os we attempt to select a balanced ration consisting of fat, protein, and carbohydrates, so in rectal feeding we select the same ingredients. The protein should, however, be predigested, but not beyond the stage of peptone, for its absorption takes place before the active putrefactive process begins, as it will with native albumens (egg, milk, and beef juice). We cannot, however, use more than 60 grams (2 ounces) in this way without irritating the mucous membrane of the rectum, when it becomes intolerant of any fluid. The use of the predigested casein preparations for this purpose is to be avoided because their absorption is extremely slow. Raw beaten eggs are particularly well adapted for a short time, and then their absorption can be hastened by the use of cooking salt (a gram to an egg), but, as the absorption is slow, as soon as the dejections show the offensive odor of putrefactive products a change must be made to some other form of nutritive agent, or diphtheritic proctitis may be set up. In the meantime the rectum must be washed out with water containing boric or salicylic acid. The carbohydrate can be employed in the form of starch, which becomes converted very slowly to sugars by the diastase of the succus entericus and by the bacteria; but, as this process is a long one, it is better to use a partially dextrinized food, like many of the children's foods on the market, or even sugar itself, remembering that not more than 10 per cent may be added without the liability of causing diarrhea. Unfortunately, fat is wholly unsuited for rectal feeding; it is not digested, and practically none of it is ordinarily absorbed, as one can easily convince himself who takes the trouble to examine a stool after a nutrient enema. When, however, chopped pancreas is added to the enema, as much as 20-50 grams of fat can sometimes be brought to absorption through the activity of the digestive enzyme in the former. The various pancreatic extracts do not contain steapsin, and are of no value for this purpose. The vehicle for the transport of these materials is milk, which is generally well utilized in the rectum, but the amount must not exceed 250 c.c. Naturally, with such a wide range of ingredients, considerable ingenuity has been expended in devising nutrient enema, each of which carries the name of its originator. Three of the more popular formulas are given:

BIAL—VON MEHRING.

Dried peptone (Witte)	25 grams
Saccharum lactis	25 grams
Tincturi opii	10 gtt.
Water	200 c.c.

BOAS.

250 grams milk	300 calories
2 egg yolks	
Pinch of salt	
1 tablespoonful red wine	
1 tablespoonful predigested carbohydrate, like Mellin's Food	

EWALD.

2 eggs	275 calories
Pinch of Mellin's Food	
100 c.c. 20 per cent grape sugar solution	
1 wineglassful red wine	
1 teaspoonful Witte's peptone	

It can be readily seen that even if four such injections can be given daily, and they are wholly absorbed, not more than 1,200 calories can be imparted in this way, but it is a fact that absorption under these circumstances is very faulty, and is increasingly diminished the longer such feeding is carried out, so that this method of nourishment must necessarily soon reach an end and can be used only for emergencies, both on account of the undernutrition and the intolerance of the rectum. As an adjuvant to feeding by the mouth, however, where the stomach will tolerate only small quantities of food, the nutrient enemas are very valuable. As to the method of carrying out rectal feeding, it should be done only by a nurse fully acquainted with the process. The apparatus may be the same as suggested for colon washing with rectal tube and funnel, and the rate of flow may be easily regulated by the height of the latter. The rectum, if filled with feces, should always be prepared at first by an evacuating enema, repeated once only daily, and to the nutrient enema 10–15 drops of laudanum must be added to check peristalsis. The apparatus must be washed out with warm water and the fluid warmed to body temperature, or the cold, striking the rectum, will cause its speedy ejection. After each nutrient enema the apparatus must be washed out with soap and water, with a little washing soda added, for any fermenting residue clinging to the funnel or tube may cause irritation of the intestine when introduced into it.

MEDICINAL TREATMENT

Medicinal treatment, in spite of its former popularity for digestive disorders, may be limited to a very few agents; four purposes we have in view to accomplish: (1) to increase or restore the hydrochloric acid of the stomach when deficient or absent, and incidentally to stimulate the pancreas, which is apparently also in a state of lethargy under these conditions; (2) to neutralize the excess of mineral acid and to restrict the exaggeration of gastric secretion when the glands are over-stimulated; (3) to improve motility when impaired, for which it is generally conceded no drug has any specific action; (4) to check fermentation or even putrefaction in the stomach and intestine; (5) to check pain; (6) to regulate the movements of the bowels.

Acids have been employed ever since the normal acidity of the gastric juice was found to be due to a mineral acid, and of these the officinal dilute hydrochloric acid (10 per cent) has been most employed, though dilute nitromuriatic still has its adherents. Of course one must first, by analysis of the gastric contents, be assured that this acid is diminished or absent in the same. We cannot hope to replace the amount usually secreted by the stomach, for one meal would require 320 drops of the dilute acid to produce a 2:1,000 solution of the absolute acid, such as is found ordinarily in a gastric content, an amount impossible of ingestion. Furthermore, it would require 100 drops of the officinal dilute acid to digest 2 eggs, so that it is evident how puny our efforts are to replace the normal acid of the stomach; hence our hopes rest on stimulating the secretion of hydrochloric acid, and incidentally, of course, of gastric juice, for it has been well established that deficient acid means impaired secretion of the digesting fluid, and, in fact, experiment demonstrates that this result follows the ingestion of the officinal product. Bickel, for instance, showed in a dog which possessed the small stomach as a result of Pawlow's operation, and was suffering from gastritis and absence of hydrochloric acid, that when milk alone was given it to drink, no acid appeared in the small stomach, but, if 7.3 c.c. of our officinal acid in 200 c.c. of water was poured into the larger stomach and an hour later 200 c.c. of milk was poured in, the smaller stomach not only contained hydrochloric acid then, but for hours later, though, of course, no communication could occur between the divisions of the stomach. Bickel also showed that the secretion of acid by the diseased stomach was unaffected if officinal acid was given during digestion, but the stomach promptly responded with its secretion if the

medicinal agent was given before the animal begins to eat. It is sometimes curious to note that patients declare that great relief has been obtained from the medicinal use of hydrochloric acid when repeated examinations of the gastric contents fail to show any return of it to the secretion. In addition, hydrochloric acid is supposed to stimulate the secretion of enzymes, and in cases of achylia where both rennin and pepsin were absent they have been restored by giving hydrochloric acid (Minkowski). Another activity already mentioned of the acid is the stimulation of an active pancreatic juice, and Glaessner actually reports that in a woman with a pancreatic fistula he could double the amount and activity of the pancreatic juice, by giving hydrochloric acid. It is still a question whether hydrochloric acid exerts any antifermentative or antiseptic action in the stomach on account of the state of extreme dilution which it must assume there, but in cases of anorexia it often arouses the appetite, like one of the bitters. On the contrary, a mineral acid should never be used when there is an excess of hydrochloric acid in the stomach. There are many ways in which hydrochloric acid may be given, but my preference is to add 10-15 drops of the officinal dilute to a glass of water, of which half is to be taken through a drinking tube before the meal and the other half after it. For those who cannot carry the fluid about, or who dislike the taste of the acid, acidol (bretain hydrochloride) in half-gram tablets, each containing 4 to 5 drops of the free acid, is an admirable substitute, but it is expensive. One or two are to be dissolved in a wineglass of water and taken directly after meals. The solution is pleasant to take, does not injure the teeth if taken directly after dissolved, and the free acid is gradually liberated in the stomach. The tablets should not be swallowed undissolved because of local irritation. These tablets are also provided with the addition of pepsin (acidol pepsin), but in my experience they are no more effective than those containing the hydrochloric acid alone. They are put up in tubes of 10 tablets each, so that, by prescribing for 10 or multiples of 10, one obtains unbroken containers. Another excellent combination where hypotony exists coincidentally with achlorhydria is a mixture of equal parts of tincture of nux vomica and dilute hydrochloric acid, of which 15 to 20 drops are to be taken in a glass of water under the same conditions as the acid alone.

Alkalies have been employed for ages medicinally without any unanimity of opinion among investigators as to their effect beyond the immediate neutralization of the acid present, be it mineral from hypersecretion or organic from fermentation, in the stomach. In small

doses, though a portion of the hydrochloric acid is neutralized, this is followed, some say, by an increased secretion of gastric juice. Large doses diminish the secretion, and it is generally conceded that long employment of Carlsbad salts diminishes the hydrochloric acid and the pepsin (gastric secretion). Bickel, with his gastrostomized dogs, found that, when an alkali was placed in the larger stomach, the smaller failed to secrete an acid gastric juice, though there was no contact, even when pilocarpine was injected, which ordinarily produces a free flow of acid-containing gastric juice. The experimental results may, however, be determined. Clinically we know that persons suffering from hypersecretion are benefited temporarily by the use of alkali, and there is no reason to believe that there are any unfavorable secondary results. The alkali should always be given one or two hours after the meal, the period of highest acidity, and not before or directly after meals. The existence of the hypersecretion must always be determined by the examination of gastric contents. Ordinarily the time at which the alkali is to be taken can be left with the patient, who can usually tell with fair accuracy when his "burning pain," as he calls it, begins, and the alkali should precede this by a few minutes. When, as sometimes happens, there is a continuous secretion, the patient is aroused in the early morning hours by the pain, and a dose of alkali prepared and placed at his bedside the night before, after being taken, will enable him to finish his night's rest. It is a generally entertained opinion among the laity that continuous use of sodium bicarbonate, or saleratus, is harmful—"eats out" the lining of the stomach, as they express it—but when used solely for hypersecretion and not for every discomfort of which the digestive organs may be guilty, there can be no harm in its use, though it is rarely a constituent of my prescriptions for reasons stated later. It is very difficult to make the "punishment fit the crime"—in other words, to gauge the amount of alkali to be given by the amount of hydrochloric acid in the gastric contents, for some individuals with an excessive acidity will complain but little, while others with but slight increase, or even an acidity below normal, will complain bitterly of "heart-burn." Zweig suggests in these latter cases that the secretion is very rapid for a short period after food is taken, but the high acidity is diminished by the dilution of the alkaline fluid, so that at the end of an hour (the usual period of removal) the acidity is not above normal (concealed hypersecretion), and in such cases recommends that the alkali be given directly after meals. Two groups of alkalis have won the favor of the medical profession—the carbonates of the simple alka-

lies, like sodium bicarbonate or carbonate, and the heavier metal, magnesium as an oxide, usually calcined, to form the finer product. When brought in contact with hydrochloric acid, the latter is found to bind or neutralize four times as much, weight for weight, as the former. It is bulky, however, and not so pleasant to take, except as the milk of magnesia or magma magnesiæ of the Newer Formulary, containing 5 per cent of magnesium hydroxide or half a gram ($7\frac{1}{2}$ grains) in every dessertspoonful. The amount of alkali to be given varies roughly as the total acidity of the gastric content. If as high as 80, 8-10 grams of sodium bicarbonate or 2 to 3 grams of magnesium oxide should be given three times daily, to neutralize, theoretically, the acid of the stomach; but, as complete neutralization is not desired, and only such a reduction that the patient is free from discomfort, in my experience $\frac{1}{2}$ to 1 gram, or 10 to 20 c.e., of the milk of magnesia, are sufficient. Where atony or muscular insufficiency of the stomach exists, the bicarbonates are much less desirable, because the carbon dioxide, set free, still further distends the weakened organ. The artificial Carlsbad salts also serve admirably for hypersecretion, given in doses of $\frac{1}{2}$ teaspoonful in a half cup of hot water on rising and an hour or two before the evening meal. My favorite prescription, however, is as follows:

R Atropinæ sulphatis 0.010 or $\frac{1}{6}$ grain
Magmatis magnesiæ, N.F. 240.0 or 8 ounces
M. Sig.: Dessert-spoonful a half-hour after meals.

With this mixture it has usually been possible to free the patient from the "heartburn" of hypersecretion. If there are accessions at times, he is simply required to scrape off from a cake of magnesia, suspend in water, and drink enough to check the increased acidity. Sodium citrate, which was a favorite with Boas for this purpose, is said to subsequently stimulate gastric secretion and has fallen more or less into disrepute.

Bitters and stomachics are, perhaps, the most ancient of our remedies, for even to our forefathers the principle scientifically established by Pawlow was known—that you must arouse appetite before you could insure your patient an efficient digestion. Other than for this act of arousing appetite, the bitters have been shorn of their supposed power to stimulate gastric secretion *per se*, being but little better in this respect than an equal amount of cold water. At least the active influence of this class of remedies on stimulation of gastric juice, when it does occur, comes *after* the drug has left the stomach, so that they should be given half an hour to an hour before food is taken. With

these scanty proofs of the efficacy of bitters in improving both motility and secretion, we must content ourselves, and fall back on the old empirical formula that people improve in appetite and digestion on their use. The number of these bitters is vast, but one can get along with the few we have mentioned, and the others in the group have never accomplished any result that these could not do:

1. *Nux vomica* in the form of the tincture, in 10-drop doses, fifteen to twenty minutes before mealtime in a wineglass of water.

2. *Gentian* in the form of the compound tincture, which also contains bitter orange peel and cardamom, in teaspoonful doses, well diluted, some little time before meals. A favorite combination at the clinic is as follows:

R Tincturæ nucis vomicæ 10.0 or 3 drams
Tincturæ gentianæ compositæ 50.0 or 1½ ounces
Elixiris pepsini, N.F., q.s. ad 100.0 or 3 ounces
M. Sig.: Teaspoonful in water before meals.

3. *Condurango* in the form of the fluid extract, though long since having lost its reputation for the cure of gastric cancer, forms, in 20- to 30-drop doses, given in water before meals, an admirable bitters, and can usually be procured at all apothecaries, though the *Pharmacopeia* has dropped it.

4. *Orexin*, chiefly used in the form of the tannate, has proven very satisfactory in my hands for arousing appetite and restoring the flow of gastric juice in achylia of nervous origin and in persistent nausea which often accompanies the same condition. It is best given in tablets of 0.25 grams each (4 grains), which should be crushed and taken with a half glass of water at least an hour before the meals. These tablets are put up in tubes of ten each, and, by ordering that number or a multiple, original containers can be obtained. They are also sold by Merck under the name of orexoids, but are, however, absolutely contraindicated in chronic gastric ulcer, hypersecretion, nephritis, and in all circumstances where vomiting must be avoided (recovery from abdominal operations).

5. *Creasote* was introduced largely by Klemperer for hypomotility and failing appetite. It may be given in capsules containing 0.05 gram (1 grain) with milk sugar 0.3 (5 grains) each, or in pill form, or often, for its suggestive effect, in sherry wine, as follows:

R Creasoti 1.0 or 15 grains
Vini xericī q.s. ad 100.0 or 3 ounces
M. Sig.: Teaspoonful in water before meals.

It is needless to say that only the beechwood creasote should be used and never the synthetic.

Ferments have long been employed to accomplish digestion in the stomach or intestine, but, with few exceptions, have proven disappointing. At first it was the various diastases which were to aid the digestion of starch where hypersecretion was present, but, if the examination of the stool is carefully followed, little change can be seen in the number of starch granules when either ptyalin, the various malt diastases, or taka-diastase is used; in fact, it is not at all certain that the increased gastric secretion is necessarily the cause of this loss of starch to the body.

Pepsin, too, has had its vogue, but at present we realize that indications for its use grow less and less. If hydrochloric acid is present, we always find pepsin; if absent, then pepsin is often present as a mother substance, to be promptly activated by large doses of hydrochloric acid. One manufacturing house has made a fortune out of such preparations as a combination of pancreatin and pepsin, not realizing, as the Scriptures have it, that the "Lean kine will eat up the fat kine," or, in other words, that trypsin is destroyed by the pepsin-hydrochloric acid of the stomach. Another favorite preparation was wine of pepsin, of which the alcohol would promptly stay the hand of the pepsin if it were at all active; yet, such is the force of old associations and former beliefs, that two preparations still form a part of my armamentarium—elixir pepsini used largely as an elegant excipient, and acidol-pepsin—in both of which preparations there is, in my mind, not the slightest expectation that the pepsin adds to the efficacy of either.

Pancreatin and *pankreon* are also frequently used without, according to my observation, accomplishing much when the control is the examination of the stool and not the feelings or impressions of the patient. Both preparations are best given in powder or capsule, for the tablets often fail to dissolve in the canal and are found in the stool. *Pankreon*, prepared by treatment of pancreatin with tannic acid, is said to be impervious to the action of gastric juice and to contain all of the ferments of the pancreatic secretion, a statement not worthy of full credence, for steapsin is a most elusive enzyme and is usually destroyed or lost in a fresh extract of pancreas in a short time. Yet there can be no doubt that the diarrhea which follows achylia is very much benefited by *pankreon*, while the amount of connective tissue and meat fibers in the stool diminishes, and there is undoubted evidence that the utilization of fat in pancreatic disease improves under its

use; in fact, some would make this improved absorption of fat after its ingestion the means of diagnosing an impaired pancreas. It is best given in capsules in doses of 0.3-0.5 gram (5-7½ grains) just before meals. In clinics, where such preparations are not available on account of their cost, pancreatin in similar doses may be used in keratin-covered pills.

Papain and *papayotin*, both derived from the sap of the carica papaya, have been employed by many and recommended by some, while others disclaim any therapeutic value for them, yet both are chemically alike and form a whitish-yellow powder, soluble in water which has been rendered slightly alkaline or acid. It is evident that it will digest raw egg albumin, or fibrin in neutral and slightly alkaline solution, nor is this action stayed by slightly acid reaction, but on cooked egg or meat it has little or no effect; hence it can never form a substitute for the pepsin of an active digestion. It is recommended in chronic gastritis, gastric cancer and its accompanying dilatation, but should never be used in hypersecretion or gastric ulcer. My experience has been confined to its employment in functional achylia, where, according to the statements of the patients, it benefited their discomfort, but examination of the gastric contents during its use never showed any change in the coarse, undigested appearance of the bread. It is to be given as a powder, in doses of 0.25-0.5 gram (4-7½ grains), suspended in a little water, just after meals, and may be repeated two or three times during the digestion. It can also be procured in tablet form, whose administration is much more convenient and probably as effective.

Gastric secretion can be controlled only to a moderate degree by therapeutic agencies. The means for increasing secretion have already been mentioned under acids and stomachics, and to that list we can add only pilocarpine, which increases the volume of the gastric juice as well as the pepsin, but not its hydrochloric acid in proportion. There are so many unpleasant features, however, attached to its use (salivation, perspiration, etc.) that its employment for this purpose is impracticable. For the diminution of gastric secretion we have only belladonna and its alkaloid, atropine, or some of the various modifications of the latter, like the methylatropine bromide or methylatropine nitrate (eumydrine), which apparently have the same inhibitive influence on secretion and are much less poisonous. It has been fully demonstrated that atropine not only diminishes the amount of gastric juice and its acid without change in the pepsin content, but also checks the motility of the stomach; hence it can be seen that atropine possesses

this advantage over alkalies—that it does not neutralize the acid already secreted, but checks such secretion. Furthermore, atropine stays the tendency to cramps, and in general exercises a soothing influence on the excitability of the sensory terminal nerve endings in the organ. It is employed to best advantage in hypersecretion, gastric ulcer, pyloric spasm—whether due to the latter, as some claim, or to the hypersecretion alone—and in spasm of the cardia. In addition, it can be used advantageously in spasm of the colon, anal fissure, and ileus due to bands and adhesions by relaxing the accompanying contraction which causes stenosis; in fact, in some cases in which an operation appeared to be the only means of relief the stenosis has been overcome by hypodermic injections of 0.001 gram ($\frac{1}{60}$ grain) of atropine sulphate. As a continuous means of treatment, atropine sulphate may be given in doses of 0.0005–0.001 gram ($\frac{1}{120}$ – $\frac{1}{60}$ grain), either in tablets or, in conjunction with an alkali, magnesia, or sodium bicarbonate, as a powder just before meals. The custom of the German school to direct that such a mixture be dispensed in bulk to the patient, to be given in doses as large as can be taken up on the end of a knife, is not safe, and the powder should always be divided into the required doses by the druggist. The extract of belladonna may be given in doses of 0.02–0.03 gram ($\frac{1}{3}$ – $\frac{1}{2}$ grain), either with the alkali as a powder or, better still, in the form of a suppository, which may be employed at bed-time, while the alkali is given during the day. Methylatropine nitrate (eumydrine) forms an admirable substitute for atropine, as stated, and can be given in 1- or 2-mgm. doses, either alone in pills or drops, or added to alkaline powders or to milk of magnesia or bismuth, since it is often given to allay hypersecretion, which the alkalies only temporarily relieve. The disadvantages of atropine are the peculiar susceptibility or idiosyncrasies manifested by some persons even when it is given in perfectly safe doses, which consist of dry throat, delirious fancies, flushing, and sometimes erythema, all of which can be avoided by the use of eumydrine. The disadvantage of the latter is the inability to procure it, as many druggists do not carry it. Only very rarely does a patient ever complain of untoward symptoms when taking eumydrine, a statement which cannot be made of atropine.

Sedatives and carminatives play an important part in therapeutics of the digestive tract, because most of the discomfort complained of by those suffering from gastric neurosis is the so-called "lump in the throat," probably due to spasm of the cardia, and the feeling of distention after a meal, which is not by any means always accompanied by physical signs of flatus. Presumably the old remedies, tinctura

cardamomi composita, spiritus ætheris compositus, menthol, and many others, are as good as the newer ones, and may be employed in the clinics, where expense counts, but in private practice validol (menthol ester of valerianic acid with 30 per cent of free menthol), in 10-drop doses on a lump of sugar or in milk, since it is not soluble in water, taken three or four times daily, forms a means of overcoming the sensation of pressure, as well as relaxing the cardia with free eructations of gas or swallowed air, whichever it may be. Morphine should never be used for this purpose, particularly if accompanied by hypersecretion, for, though at first it diminishes secretion, later it always increases it. Codeine, however, either as a sulphate or phosphate, as a constituent of powders for calming minor painful sensations in the stomach or intestines may be employed, for experiment has shown that it does not share the disagreeable after-effects of morphine. As a means of combating nausea and vomiting, chloroform water in tablespoonful doses often works well, as does cocaine hydrochloride. A favorite prescription containing this is as follows:

R Cocainæ hydrochloridi 0.3 or 4½ grains
Aquæ menthæ piperitæ 50.0 or 1½ ounces
Aquæ q.s. ad 100.0 or 3 ounces
M. Sig.: Teaspoonful in water every three hours.

Resorcinol also has a favorable influence on nausea, and can be given in 0.2-gram (3-grain) doses, dissolved in aromatic elixir. The pain associated with chronic ulcer of the stomach or duodenum can be alleviated by anesthesin in 0.2-gram (3-grain) doses in capsules taken just before the time of the usual periodic pain, as well as an hour after eating if gastric, and 3 hours if duodenal. However valuable these sedatives are for relieving pain, when the disease is incurable (cancer), they should not be used to the exclusion of other remedies intended to cure the disease, for their constant use hides its progress and gives a false sense of improvement.

Laxatives have won such a strong hold on the laity that it is almost as difficult to persuade some patients to give them up as it is the use of alcohol or narcotics. Every kind has its adherents, and the so-called "patented" articles sold through questionable announcements of their advantages in the papers have largely increased this evil. Apart from a single dose, used at long intervals to unload the colon of its contents when malaise, furred tongue, and headache exist, the choice of laxatives should be confined to the mildest that will accomplish the purpose. These drugs act by increasing the peristalsis, either by direct irritation of the intestinal walls or their ganglia, or by re-

flex action from irritation of the sensory nerves. Two harmful effects follow their use—first, the intestine becomes so atonic that only the most drastic agencies have any effect, and, second, actual pathologic conditions, like gastric catarrh, achylia, and chronic enteritis, follow their use. Furthermore, their early effect is often to produce excessive hypersecretion in the stomach, which cannot be checked until the laxatives are given up. They are always contraindicated when any inflammatory disturbances, like appendicitis or peritonitis, exist, or when spasm of the colon, lead colic, or acute ileus is present. The time at which the drug is taken plays an important part in its choice. If salts are employed, like sodium or magnesium sulphate or sodium phosphate, they should be taken on rising, before breakfast, when in one or two hours there follows a copious watery discharge; if cascara, rhubarb, or the innumerable other pills and syrups which act slowly, they should be given at bedtime, when the stool follows the next morning. A list of all the drugs used for this purpose would be like that of the ships that came to Troy, but a few which have served me best will be mentioned without detracting any from the merit of the numerous others:

1. Oleum ricini, or castor oil, is to be given only when there is immediate need of a thorough evacuation, and not continually. A tablespoonful is the usual dose, taken in coffee, root beer, or with lemon juice. At present it can be procured in capsules containing 5-15 grams.

2. Fluid extract of cascara sagrada can, in general, be used with the greatest safety, as it produces (in $1\frac{1}{2}$ - to 1-teaspoonful doses at bedtime) a free movement, usually without any griping, with less disturbance in the stomach than any other of this class; in fact, it is recommended by some as a stomachic, to be given in smaller doses before meals. The unpleasant taste of this drug has been largely overcome by most manufacturing pharmacists in special preparations, such as cascara evacuant (20-30 drops) and cascara cordial (1-4 teaspoonfuls at bedtime). It can also be obtained in the dry extract, of which pills of 0.25 gram (4 grains) are officinal.

3. Aloin, which has always been employed by us in the form of pilulæ aloini, strychninæ et belladonnæ, as it was formerly termed, but now somewhat modified by the addition of ipecac and liquorice, maintained by the Pharmacopeia under the name of pilulæ laxativæ compositæ. One or two of these at bedtime may be used with comparative safety for a long time, but gastric distress after eating, sooner or later, demonstrates their effect on the stomach.

4. *Agar-agar*, introduced by A. Schmidt, is a laxative only by virtue of its indigestibility and insolubility. It can be procured in the commercial form in strands or sticks and cooked by the patient in fruit or vegetables, or some of my patients carry it about with them and nibble it as they would sweet flag or liquorice. It is also put up in the form of crackers, which can be obtained at almost any apothecary. *Regulin*, too, is a very elegant preparation of agar-agar, with 25 per cent of watery extract of cascara, and may be given in 1- to 2-teaspoonful doses, but, like all our imported medicinal articles, the duty makes the price beyond the means of any but the well conditioned.

5. Liquid petroleum, which has been purified for internal use, also has the same effect as agar-agar, being indigestible and unabsorbable in the digestive tract. It is given in tablespoonful doses night and morning. Ordinarily it is taken without any distaste, but rarely some varieties have a slight odor of kerosene, so that it is best to add 0.5 gram of oil of gaultheria to each 240 c.c. (8 ounces).

6. *Hydrargyrum chloridum* mite has been undoubtedly in former ages the curse of humanity, and no one will ever write the history of its victims, stomatitis and diphtheritic colitis following its free-hand administration, which undoubtedly caused the revolt against heroic dosing and made way for the newer fads of homeopathy, eclecticism, and Thomsonianism. As at present administered, however, in doses of 0.006 gram ($\frac{1}{10}$ grain) in tablet form, or with the addition of sodium carbonate, 0.06 gram (1 grain), repeated hourly for 10 doses, it has proved as effective for the purpose intended (especially if followed on the succeeding morning by a dose of sodium phosphate or artificial Carlsbad) as the large doses of the last century, without any of the dangers of those quantities. The power of calomel to render the intestinal canal aseptic has been largely overestimated as well as its theoretical power to increase the flow of bile. Both apparent actions are wholly dependent on the increased peristalsis by which un-reduced bile pigment and the putrefying contents are ejected.

7. Phenolphthalein, a mild laxative, in evening doses of 0.1-0.3 gram ($1\frac{1}{2}$ -5 grains) is to be recommended when continued use is desired, but not an immediate and effective clearing out of the intestine. It will, however, prove disappointing, for it soon loses its effect on the same patient, and not rarely after long use causes colon catarrh.

Antidiarrheal remedies are divided into three classes, according to the method of their action:

1. The first group is that class which dulls the nervous endings in the intestinal canal and at the same time arouses to activity the retarding filaments of the splanchnic nerve. The best of this group is opium, but we may add its derivatives—morphine, codeine, heroine, as well as belladonna with its alkaloid atropine. If we desire only to check frequent discharges, there is no better remedy than tincture of opium or deodorized tincture of opium in 10-drop doses three times per day. One must not employ opium at the beginning of the diarrhea, but allow the noxious contents of the intestines to escape, or possibly aid this act by calomel or castor oil. It is sometimes difficult to decide just the point where the opium therapy is in order. Perhaps the best way is to watch the stools; if they are watery, possess no longer a putrefactive odor, and there is much tenesmus, then is the time for the employment of our agent. In chronic and nervous diarrhea, opium is wholly contraindicated because it does not modify the conditions producing the diarrhea, and continued use soon leads many into the habit.

2. The second group contains the astringents which contract the blood vessels and diminish secretion; hence they are indicated where the mucous membrane has undergone pathologic changes and where opium is contraindicated. One must not expect too much of this group of remedies, for the amount given is small and the length of the intestinal canal enormous in proportion, and the exaggerated peristalsis does not allow the medicament to remain long in contact with the diseased wall; therefore the astringent must always be reinforced by hygienic and dietetic treatment. The most universal of this group of remedies is tannin, and practically all of the former remedies in repute—oak bark, choke cherries, huckleberries, etc.—contained it. Because tannin soon acts unfavorably on the stomach, several preparations have been devised combining tannin with some inert material, like albumen, gelatine, etc., which will aid its passage through the stomach without decomposition, so that solution can take place only in the duodenum. Our own experience has been confined to tannalbin, which, in doses of 0.5 gram ($7\frac{1}{2}$ grains) in capsules, taken four times daily, proves very efficacious. The various others—tannigen, tannocoll, and tannoform—we have no doubt are equally efficient.

3. The third group, containing the antiseptics, is so numerous that only a few representatives can be mentioned. These remedies check diarrhea by inhibiting the formation of putrefactive products which irritate the intestinal mucous membrane. According to E. Schuetz, all efforts to render the intestine fully aseptic are in vain, and we can

only hope to produce a modified form of freedom from the bacteria in its lumen. First we should consider bismuth preparation, the sub-carbonate, the naphtholate, the salicylate, the tannate, and bismuthose, all of which are best taken in capsules in doses of 0.3 gram (5 grains) four times daily. Unfortunately, however, bismuth acts on the stomach by restricting its secretion, so that where there is hypochlorhydria, as is true in most so-called gastrogenous diarrheas, bismuth is contraindicated. Bismuth subgallate (dermatol) has, in addition to its astringent action, a marked antiseptic influence. It is often well to unite the lime and bismuth preparations with a sedative, as in the following:

R. *Codeinæ sulphatis* 0.6 grams or 10 grains
Mentholis 2.0 grams or $\frac{1}{2}$ dram
Bismuthi subsalicylatis 5.0 grams or $1\frac{1}{4}$ drams
Calcii carbonatis 20.0 grams or $\frac{2}{3}$ ounce
M. *Fac. in chartulas aut capsulas XX.*

Sig.: One every four hours.

We may also include the use of dilute hydrochloric acid as a remedy against diarrhea when of the gastrogenous variety, because, as A. Schmidt has shown, this is often due to hypochlorhydria or even achylia, and the undigested connective tissue which passes into the intestine forms an excellent culture medium for subsequent putrefactive bacteria, whose products are an irritant to the mucous membrane. The use of antiseptic material against fermentation or putrefaction in the stomach is a matter of dispute. Probably the best way to check such processes is by improving the motility of the stomach, which is much more easily said than accomplished, for in this effort particularly our success is not of the best. Stiller's resorcinol has proved in my hands as good a means for this purpose as any, while next to it comes saccharin, given in doses of 0.06–0.3 gram (1–5 grains), dissolved in hot water. Ichthyol, too, in capsules containing 0.2 gram (3 grains), taken directly after meals, has served me well in many cases, but unpleasant eructations usually follow its use, and, on account of this, ichthalbin, a combination with albumen, can be used, but in decidedly larger dose of 0.6–2 grams.

SURGICAL TREATMENT OF THE GASTROINTESTINAL CANAL.

Every internist must eventually reach conditions in the treatment of the gastrointestinal tract which cannot be managed with the ordi-

nary means of medical treatment, such as massage, baths, medicines, etc. These are comprised in such pathologic states as adhesions, chronic ulcers, stenosis, hernia, and mechanical difficulties of a similar nature. Hence he must proceed to seek the aid of a surgeon, and prescribe an operation in exactly the same manner as he would prescribe medicine or massage. After, however, the operation has been performed he must never consider that his duties end, as this procedure is often only a preliminary undertaking to some successful and effective treatment by the means which have already been mentioned. A great mistake is made by the physician in giving up the patient to a surgeon and then regarding his own liabilities as having ceased. Many a case of gastroenterostomy has failed ultimately to grant the desired relief to the patient simply because diet was neglected after the convalescence.

While at present, and wisely so, medicine and surgery are distinctly divided, yet it behooves the physician to have a clear idea of what surgical means will aid his patient. To accomplish this, his knowledge should not be limited to an acquaintance with only the literature of surgery, but he should, as far as possible, attend every operation on his patients and advise, if necessary, in any case after the abdomen has been opened on account of the fact that his diagnosis can never be absolute, as well as a means of increasing his knowledge of pathologic conditions by personal observation—autopsy *in vivo*, as it is sometimes called.

This presentation of the surgical treatment can be systemized in considering, first, the indications for operation; second, the appropriate surgical procedure; and third, the results.

Esophagus.—Under this division of the alimentary tract we will first consider cardiospasm, which not infrequently causes the physician a great deal of difficulty, though not ordinarily a dangerous complaint.

For *strictures resulting from cardiospasm*, excellent results have been obtained by the use of rubber bulbs, which, collapsed and passed through the stricture into the stomach, are then moderately distended with air and drawn back through the stricture. These manipulations often, after eight days, produce a perfect and persistent cure. Very often simple passage of a large, hard esophageal bougie may prove effective, provided that no pocket exists which deflects the instrument from its way through the esophagus to the stomach. Furthermore, the method introduced by Mixter of tying a piece of thread to a fragment of bread and allowing the patient to

swallow it, over which a sound may be threaded, will accomplish the purpose when bougies fail to enter the narrowed passage.

Myer, too, reports eleven cases of cardiospasm with obstruction of the esophagus, of which seven were treated by stretching the cardia. Of these, five resulted in a complete cure.

Foreign bodies in the esophagus frequently require the aid of surgery. The most common of these is probably false teeth which have been swallowed in sleep or during an attack of coughing, and whose presence produces very unfavorable symptoms. If the obstacle is too low to be readily grasped with forceps, Franke recommends that an incision should be made in the side of the neck, which will extend to the esophagus, but not into it. In this way, by manual manipulations, such foreign bodies can often be moved toward the mouth so that they can be seized with forceps. The advantage of this method of treatment is the avoidance of cellulitis, so frequently set up by the discharge of bacterin containing secretions from the esophagus, and the shortening of convalescence.

Benign strictures often arise from syphilis or mechanical injuries to the esophagus. When they exist, either with or without a diverticulum they are to be treated, according to Sencert, in the following manner. When the simplest sound can be passed, progressive dilatation is to be pursued, if not, then esophagostomy, under the direction of the esophagoscope. If the stricture cannot be distended, or if, from efforts toward this object, inflammation occurs, gastrostomy is recommended. If the stricture cannot be passed, then gastrostomy is demanded with efforts at dilatation from below. If this is not successful and if emaciation still persists, an esophago-jejuno-gastrostomy must be performed.

The artificial formation of an esophagus is especially difficult on account of the frequent possibility that the separated intestinal part which is carried through the artificial canal toward the neck may undergo necrosis. Under these conditions, Krogius urges a radical operation—that is, resection in all cases of benign esophageal stenosis. Only nine such operations have been reported, while he reports two more, in all of which with one exception the results have been satisfactory, both as to life and the removal of the obstruction. He recommends, at the earliest to overcome the narrowing by means of sounds, and then the passing of sounds through a gastrostomy wound if the former above is unsuccessful. If this fails, however, he recommends early the radical operation after the installation of a gastric stoma, about which the patient may be fed for sometime after the

operation. He concedes that, while this is successful in benign strictures, such operations for cancer of the esophagus rarely terminate favorably.

With *malignant growth of the esophagus* we have an entirely different proposition, and one which resists the utmost efforts of the surgeon. Myer recommends that in operable cancer of the esophagus the latter should be separated above the growth, should be anchored outside the thorax, and then a new esophagus formed under the skin and united with the upper fragment of the old one. This, according to him, is much more satisfactory than to simply establish a gastric fistula.

As can be readily seen, these operations, of the greatest severity in character, are only palliative, and the custom has grown of establishing, instead of the gastric fistula, a jejunal fistula, through which the patient may be fed by a permanently introduced rubber tube. My experience, however, has been that patients have emaciated rapidly, and death has usually been a matter of a few days or weeks.

Stomach and Duodenum.—The *simple gastric and duodenal ulcer*, as well as the callous gastric ulcer, often demand operation for their relief. These cases are often of long duration, with repeated attacks and long periods of freedom from attack, but can rarely, if ever, be pronounced cured, if chronic, by medicinal treatment.

The operations for their relief consist chiefly in posterior gastrojejunostomy, with or without resection. The simple ulcer, if situated at or near the pylorus, is usually relieved by the single operation. When, however, situated at the lesser curvature, or when the so-called callous ulcer exists, resection, if the patient's condition allows, is absolutely necessary for permanent relief. The reasons for this are largely that gastroenterostomy does not relieve the so-called saddle ulcer of the lesser curvature, and, if the patient is near the age of 50, there is, as is well recognized, a constant danger of cancerous degeneration.

Kuettner argues in favor of the resection of all callous ulcers, first, because it is not possible to distinguish grossly such ulcers from cancer, and, second, because the mortality of resection is not much greater than that of gastroenterostomy, while the results of resection are much better. In substantiation of these points he reports that of twelve patients in whom gastroenterostomy was done only for callous ulcer, five later developed cancer, and of nineteen who were resected, seven showed cancerous degeneration by microscopic examination.

Ray declares that, when ulcers are situated at or near the pylorus, only a gastroenterostomy is indicated, while in those situated in the

lesser curvature and in the posterior wall of the stomach a resection of that portion of the stomach containing the ulcer is to be recommended. In general, resection is to be preferred to excision, since by the former all the adjacent pathologic portions of the stomach wall are removed, thus avoiding the danger of subsequent cancerous degeneration.

Zweig reports that, in twelve cases of gastroenterostomy for gastric ulcer not situated at the pylorus, in seven instances results were unfavorable (four cases of death and three severe recurrences), and in only five was there a permanent recovery.

Riedel reports that, in eighteen cases of gastric ulcer in which he resected the middle portion of the stomach, fourteen reported themselves completely restored to health and able to follow their usual pursuits in life, and four were personally seen by him and found to be free from their former symptoms.

Rubritius reports that, of one hundred and twelve cases in whom gastroenterostomy was done for ulcer situated at the pylorus and also in the duodenum, all were restored to health; also, in addition, bleeding ulcers and perigastritis were favorably influenced.

Only such ulcers as are not accompanied by adhesions of the surrounding organs and tissues can be relieved by gastroenterostomy, while large adherent, callous ulcers must always be resected.

Claremont, basing his conclusions on two hundred and fifty cases of operated gastric ulcer, declares that when the posterior gastroenterostomy alone is employed, the mortality need not be more than 3.5 per cent. The subsequent recovery from the gastric ulcer by means of this operation alone depends largely on its position. The prognosis is just so much more favorable the nearer the ulcer is to the duodenum. In pyloric ulcers, 62 per cent are relieved and in duodenal ulcers, 73 per cent.

In a résumé of one hundred cases of ulcer, Spischarny comes to the conclusion that the permanent results of simple gastroenterostomy and the same with resection are alike. Immediately after the operation, however, the mortality is much less after gastroenterostomy; hence he would choose resection in only those cases whose age and the callous character of the ulcer scar lead to the greater possibility of cancerous degeneration.

Borszéky reports concerning the treatment of gastric ulcer by surgical procedure in the clinic at Budapest, and the results of such operations. A special interest was aroused by the operative results of

callous ulcer, which so persistently resists medicinal treatment. Through simple gastroenterostomy alone half of these cases were cured. He considers that the jejunal ulcer after gastroenterostomy is much more common than is supposed, but very often they are not recognized. The prevention of these postoperative ulcers lies solely in the internal treatment after the completed gastroenterostomy. This author does not recommend resection unless the nature of the scar is in doubt—that is, suspected of being malignant. Furthermore, he considers that gastroenterostomy has no influence over the gastric hemorrhage if the pylorus is patent, and only a limited influence if the pylorus is stenosed.

A report from the clinic at Copenhagen, based on five hundred and twenty-two cases operated for gastric ulcer, with the usual associated conditions of perforation, hemorrhage, stenosis, hourglass stomach, and perigastritis, shows that 71 per cent were cured, 6 per cent improved, and 22 per cent met with no relief. No statement is made as to how often resection and excision were employed.

With gastroenterostomy from the clinic at Vienna the statistics of one hundred and sixty-seven cases operated for gastric ulcer showed that the mortality of the operative procedure has been reduced to 6.6 per cent and of simple gastroenterostomy to 3.5 per cent; 52 per cent were cured, 15 per cent improved, and the remainder met with no relief. The prognosis improves with the nearness of the ulcer to the duodenum. Sixty-two per cent were improved with ulcer at the pylorus, 44 per cent when situated some distance from it, and 73 per cent when in the duodenum itself.

Perforating ulcer of the stomach or duodenum also demands immediate surgical relief. The results of this operation are often poor on account of the shock and the loss of blood, yet it seems that the following principles may be established. Operation is to be recommended as soon as a reasonable diagnosis is established, but never, of course, when the patient is in collapse. Resection should never be attempted at this time. When the strength of the patient will allow, a gastroenterostomy must be performed. It is rarely necessary to irrigate the abdominal cavity, but it should be thoroughly drained.

Dege, basing his conclusions on three hundred and fifty-five cases of operation for perforated gastric and duodenal ulcers, finds a mortality of 48 per cent and recoveries of 52 per cent. As to the character of the operative procedure, no unanimity exists. The minority of surgeons believe in resection of the pathologic portions of the stomach, while some simply excise the ulcer site, and others declare for the

simple suture of the ulcer. If a subphrenic abscess results, recovery often follows from simple incision and drainage. The condition of the patient also counts in the decision.

Steinthal reports twelve cases of gastric and duodenal ulcer perforating into the peritoneal cavity. Of these, seven were rescued by immediate operation, and five died twelve hours after the perforation. This emphasizes distinctly the necessity of early operation.

The *hourglass stomach*, resulting from scar tissue of an ulcer, is usually amenable to relief by surgical intervention. When, however, due to cancer, the case is usually hopeless, except possibly for a palliative operation. Two or three operations have been suggested for the hourglass stomach, of which the following views have been expressed by various well-known and competent authorities.

Druard declares that the hourglass stomach must be subjected to different surgical procedure, according to its nature and origin. When callous ulcer is present, it demands resection of the stomach and union of the separated portions. A simple gastroenterostomy in such conditions does not restore the stomach to its normal condition without a primary resection; furthermore, the possibility of a change of a callous ulcer to a cancer must always be borne in mind.

Gastro crises, dependent on interstitial changes of the spinal cord, have always proven so obstinate to medical treatment, and are accompanied by such prostration from pain and vomiting, that operative efforts are now made for their relief. This operation consists of a resection of certain nerve roots of the intercostals. Sleuke has performed this operation five times for gastric crises. He bases no great hope of cure on the operation, partially on account of the character of the illness and partially on account of the chronic morphine habit which all his patients had acquired. His advice is that operation should be performed as early as diagnosis is established in order that the possibility of the acquisition of this unfortunate habit may be avoided.

Goetz reports a case of tabes with gastric crises in which the Foerster operation was performed. Resection of the seventh and ninth intercostal nerves caused prompt relief. There is still some doubt as to which cases should be operated in this way and also which nerves should be severed.

Gastrophtosis is another condition which is favorably influenced by operative intervention, particularly when it occurs congenitally in the young.

Weiss reports a case which was cured through gastropexy. This

was accomplished by the fastening of the stomach to the anterior abdominal wall.

Beyer reports many cases of the same pathologic condition relieved by sewing the gastric omentum to the lesser curvature of the stomach. In this way the stomach is raised, and in the young remains permanently in this position.

Coffey also reports many instances of operation of the ptosed stomach by means of his so-called "hammock suspension," and has obtained some very admirable results.

Gastric cancer can be operated on with success, provided that the diagnosis is made early, which avoids the possibility of coincident metastases.

Mayo Brothers recommend in all cases of gastric cancer that one operate as early as possible. Even the presence of a palpable tumor is no indication against a radical operation. They believe that the results of operation in such cancers are just as favorable as those of cancer of other organs.

Bran established the following principles for the determination of whether a cancer of the stomach is operable. To the operable variety belong those cancers which are palpable, while those which are not palpable are probably of the medullary character, and can almost never be removed by surgical procedure. If pyloric stenosis exists, an early symptom of such a growth, especially if it is rapid, although no palpable mass can be discovered, there should be an immediate procedure to exploratory laparotomy. Rapid emaciation and cachexia often accompany a pyloric malignant growth, and indicate an early operation. The absence of hydrochloric acid and the presence of lactic are of absolutely no value in determining the advisability of operation.

Pers found that, of thirteen patients with carcinoma of the stomach in whom resection was done, two were still living respectively five and eight years after operation, two were living two and one-half years, two were living one and one-half years, and the remainder died during the first year.

Weil reports the results of one hundred and fifty-seven resections of the stomach, of which thirty-five were done for gastric cancer. Of one hundred and thirty-five of these, only thirty-one, or $22\frac{1}{10}$ per cent, survived the operation. Of the thirty-one who survived the operation, four lived more than five years, five more than four years, five more than three years, and the remainder from one to two years after the operation. Of all this vast number who were operated for cancer, $15\frac{1}{10}$ per cent were permanent cures. These

unfavorable results are unquestionably due to the advanced stage of the disease when the operation was performed.

Pans has collected statistics in one hundred cases of operation for gastric cancer. Of these, with simple exploratory laparotomy, there was $13\frac{6}{10}$ per cent mortality; with gastroenterostomy, 16 per cent mortality; and with resection, $26\frac{1}{10}$ per cent, of which last $31\frac{3}{10}$ per cent remained free from recurrence more than three years after operation.

Kocher reports one hundred and forty resections of the stomach for cancer. In the first fifty-two the mortality was $34\frac{6}{10}$ per cent; in the second series of forty-seven cases, 17 per cent; and in the last forty cases, only 9 per cent. Of forty who survived the operation, two died from subsequent complications, and twenty-two from recurrence at longer or shorter periods after discharge from the hospital. Thirteen are still living of those operated during the last six years. The number of permanent recoveries is limited to thirty cases. The site of these gastric cancers, most common, was the pylorus.

Daneel, reporting from the clinic at Heidelberg, states that in seventy-five cases operated for gastric cancer the mortality was 28 per cent. The chief causes of death after operation, are peritonitis, collapse, and pneumonia. The number of deaths occurring after convalescence amounts to thirty-nine, of which thirty-six died from recurrence.

Intestines.—*Duodenal and jejunal ulcers* frequently demand operation, both on account of the resulting strictures as well as the rarer accident of perforation. In the former case there is, of course, no urgency; in the latter, the more rapidly surgical procedure is employed the greater the chances of the patient for recovery.

Harris reports the operation of six cases of constriction of the duodenum by abnormal folds of hepatocolic ligament. The symptoms were those of a typical duodenal ulcer or gallstones.

Jejunal ulcer is often the outcome of a previous gastroenterostomy, but that result occurs much less often since the posterior operation has been employed. Whether jejunal or duodenal, excellent results have been secured by pursestring suture around the ulcer scar. Excision has never been recommended.

Syphilitic and tubercular strictures of the ileum often demand surgical treatment. These two are of a chronic character, and abundant time is given for the establishment of a diagnosis.

Goto considers operation most advisable for intestinal syphilitic strictures of the ileocecal region. One case died after operation

because the resection could not be successfully carried out. He regards the favorite site of syphilitic intestinal strictures, apart from those of the rectum, to be in the upper middle portions of the ileum.

The same author reports four cases of simple chronic inflammatory stricture of the intestine, of which three, on account of having been taken for true tumors, were resected, and only after the pathologic examination were found to be of a simple inflammatory character. He recommends medicinal means heartily, but, if these are ineffectual, a resection of the diseased portion—first, because the differential diagnosis from true malignant growth is often impossible on the operating table, and, second, the growth of a cancer at the site of the scar tissue is possible.

Derk writes concerning the prognosis of extensive resections of the small intestine. Resections of at least half of the small intestines, 300 cm., if the patient can withstand the immediate operation, is followed by permanent favorable results. After a resection of two-thirds of the entire length of the small intestine, an unfavorable outcome always follows; sometimes, however, only after years. Such extensive resections, then, are never to be undertaken except when life is threatened.

Our personal experience is that, at least with tubercular stenoses, the operation is best performed in two stages on account of the wasted condition of the patient; in the first of which the strictures are short-circuited by ileocolostomy, and the diseased portions resected later when the patient's strength has been restored. A peculiar feature often present is a persistent diarrhea, which resists forced feeding very strongly.

Incised wounds of the intestine usually require immediate surgical attention.

Kahn declares that operation should take place immediately when any of the following symptoms are present: collapse of varied degree; excessive vomiting; intestinal obstruction; frequent urination; intense pain in the abdomen; a pulse which is at first slowed, but finally becomes rapid; superficial and rapid respiration; a slight rise of temperature and a loss of liver dullness, with flatness in the lower abdomen, induced by blood or the accumulation of fluid and with rigidity of the abdominal muscles.

Magula reports three hundred and one perforating wounds of the abdomen, injuring either the stomach or the intestines. In general, such wounds heal kindly without complications; hence it is advisable, after enlarging the wound and its inspection, to sew the severed walls

together, especially when not more than twelve hours have passed since the injury was received.

Ileus or obstruction of the intestine at any point demands, of course, immediate surgical relief after the ordinary medical treatment has proven ineffectual.

Lerke reports five cases of gallstone obstruction of the ileum which were later characterized by the relatively benign character of the intestinal obstruction and the mild character of the initial symptoms. The patient should be operated as soon as the diagnosis is made.

Krogius recommends in all cases of postoperative ileus symptoms, when a general operation is out of the question, an immediate enterostomy as soon as clysters are found to be without avail and the symptoms begin to be dangerous. When the original operation is performed for intestinal obstruction with excessive dilatation of the intestinal coils, an enterostomy is recommended immediately after the primary operation as a means of prophylaxis.

Appendicitis in recent years has demanded almost exclusively the attention of the surgeon. Mild cases, unquestionably, may be treated by medicinal means, but on account of the vagueness of the attack, and one's inability to determine when a mild attack may become serious, it is always wise for the internist to be in close communion with a surgeon who may be secured early if necessary. When to operate in appendicitis has been discussed for years with somewhat varying opinions. An attempt will be made here to give the views of some of the more prominent surgeons.

Based on five hundred and sixty operated cases, Hagmaier comes to the conclusion that many cases of appendicitis reach the surgeon's hands through the abuse of laxatives, and that every individual who has passed through one attack should always remain in the vicinity where competent surgical aid is at hand.

Wanner regards appendicitis during pregnancy a much more serious illness than at any other period, and its prognosis just so much more unfavorable the nearer to confinement the woman is. Generally, peritonitis occurs more easily and there is greater danger of general sepsis. This author has operated five cases, and in only one case did the mother fail to carry the child to term. Early operation is always recommended.

Loewy insists that appendicitis in individuals beyond 51 years of age is a very rare occurrence. It produces chiefly an abscess in the iliac fossa and manifests itself by slight local symptoms and decided

disturbance of the general condition of the patient; hence the diagnosis is made extremely difficult. The operative results for this reason are very unfavorable on account of the frequent complications.

Fromme regards an early operation as the best treatment for appendicitis. When an abscess is present, it is not wise to seek for the appendix in order to remove it. It is usually sufficient to make a slight incision for the escape of the pus. After it is discharged it is not absolutely necessary to advise an interval operation, as only a few ever experience a recurrence under these conditions. The internal operation is to be performed after mild attacks as soon as no other symptoms exist. After severe attacks, one should wait from four to eight weeks before operation. The appendix is always to be removed.

Kuemmel urges early operation for appendicitis. If operation occurs at this period, the danger is vastly lessened, and the mortality in his hands sank to 0.6 per cent, if the operation occurred within the first forty-eight hours. The earlier the removal of the appendix takes place after appendicitis is diagnosed, the surer and more harmless does the convalescence follow.

Zander, reporting a large number of cases of appendicitis from the Halle clinic, declares that 9.7 per cent of all sufferers die from their attack.

Dolbrucki reports three cases of appendicitis, of which two were accompanied with hematemesis. In one of these cases a diagnosis of perforation and gastric ulcer was made. The operation, however, showed full integrity of the stomach. The removal of the appendix brought complete cure. The blood found in the vomitus was absolutely fresh. The third case distinguished itself exclusively by dyspeptic symptoms and the operation showed an appendix completely filled with pus. Its removal was followed by complete recovery.

Herman believes in exclusive operative treatment for appendicitis when the diagnosis is positive. The patient should be operated within thirty-six hours of the beginning of the illness. Wherever an abscess already exists, the surgeon should attempt to remove the appendix and not be content with simply opening the abscess; otherwise a period is often reached in which operative treatment is too late.

Schmitler, basing his views on two thousand operations for appendicitis, declares that operation in all severe cases must be performed within forty hours after the attack occurs. In other cases, one must use discretion. The interval operation is always to be recommended whenever a previous attack can be established and also after the

severest attacks, since the appendix after such attacks is never obliterated by disease.

Duvergey advises secondary laparotomy for cases of appendicitis in which, on account of the first delayed operation, peritoneal adhesions and bands have been formed, which produce extreme pain in the iliac fossa. These pains may extend over the entire abdomen, and are rarely associated with vomiting and obstruction.

Kraft, basing his opinion on two hundred and forty-seven cases of appendicitis, with mortality of 10 per cent, urges an early operation. Of these, one hundred and thirty-six were operated within forty-eight hours, with only three deaths, or 2.2 per cent. The mortality steadily increases with each hour's delay after two days' duration of the illness.

Rubesch discusses the *operative treatment of tuberculous ileocecal tumors* as follows: Immediate operative results for the enteroanastomosis were 8 per cent of deaths, while resection showed a death rate of 10 per cent. The enteroanastomosis is only a palliative operation, and, whenever possible, resection is to be carried out.

With immovable tumors, anastomosis is usually recommended whenever the condition of the patient permits, with closure of the adjacent portions of the intestine. Four cases which were operated showed multiple tubercular strictures in the small intestine.

Eschenbach reports twenty-four radical operations for tuberculosis of the ileocecal region, in which only twice could a simple resection of the cecum be carried out. In all others the entire ascending colon, and often more, had to be resected. Seven died from immediate results of the operation. In three instances, only a palliative enteroanastomosis could be carried out. Of those who underwent the operation successfully, three died later of pulmonary tuberculosis. The final results of the other cases were very favorable, which is to be considered particularly fortunate on account of the fact that they were all well advanced instances of the disease.

Thiemann reports twenty-six cases of tuberculosis of the mesentery glands. Of fifteen of these, with tuberculosis in the ileocecal region, thirteen were restored to perfect health by means of the operation.

Cecum mobile has of recent years become a fair field for the attack of the surgeons.

Steinhill publishes the results of sixty-one cases of cecum mobile. The diagnosis was based largely on colicky attacks in the region of the cecum and ascending colon, associated with persistent constipation, alternating with diarrhea at the end of the painful attacks. The

permanent results of the operation were 75 per cent recoveries, 16 per cent improved, and 4 per cent unaffected.

Sailer describes five cases of cecum mobile in which the appendix was removed without result. The symptoms are ascribed by him more to an atony of the colon and the accompanying colitis than the cecum. He is not very heartily in favor of an early operation, putting more dependence on a regulation of the stools and an appropriate diet.

Finklestein declares that the most of *malignant growths* of the large intestine, with the exception of the rectum, are found at the sigmoid, (44 per cent of all cases); then follows the cecum, with 20 per cent; 40 per cent of all such cases proved themselves nonamenable to the radical operation. In more than 35 per cent there was evidence of stenosis when first seen. Excision of the growth of the large intestine proved two to three times as successful with reference to ultimate results as the removal of the growths of the remaining intestinal canal.

According to Korte the special dangers associated with resection of the colon for malignant growth are collapse and peritonitis. Where intestinal obstruction is acute, all that one can do is to relieve the obstruction by colostomy and defer the removal to a secondary operation. The prospects of a permanent cure after removal of the growth in the large intestine are relatively favorable.

Denk recommends radical operation for the extirpation of colon cancer. He has already done thirty-nine such operations, of which twenty survive. Of these, three years after the operation, seven are apparently absolutely cured and have never had any recurrence.

Haberer reports the operation of nineteen cases of colon cancer, of whom three died at the close of the operation. Of the remainder, all were restored to health.

Schmidt, basing his opinion on sixty-three operations for tumor of the large intestine, considers resection as the most commendatory procedure. Only when technical difficulties are present, or when the condition of the patient is poor, should the operation ever be performed in two stages.

Cancer of the rectum has been attacked by the surgeon from different routes. If low down, it can be removed through the anus; if higher up, the Kraske operation is to be preferred. Often, however, the combined operation is necessary to remove all the growth.

Reiss recommends the combined operation for cancer of the rectum under the following conditions: first, when one cannot reach the growth from below; second, when palpable glands can be found high

up; third, in cancers of the true pelvic colon, where this method is superior to the single method. Danger of gangrene cannot, however, be absolutely excluded.

Ritter reports a restoration of continence after excision of the rectum for carcinoma.

Torikata reports eight operated cases of rectal cancer in men, by means of the combined operation, of whom three died. The results are not inferior to those of the dorsal.

Zinner insists that in the operation for cancer of the rectum, even when situated high up, by means of the sacral route, the opening of the abdomen should be employed only in the most extreme cases. Of three hundred and twenty operated cases, forty-four, or 13.75 per cent, died from the immediate effects of the operation.

Two hundred and fifty-six cases have been heard from at a period of three years after the operation. Of these, thirty-five died from intercurrent diseases and one hundred and twenty-seven from recurrence of the cancer. Fifty-two are still living, without any evidence of the disease.

A few surgical procedures remain, which can be discussed briefly, and whose employment is not nearly as universal as those which have already been mentioned.

'Olitis ulcerosa, according to Schmidt, must be treated by surgical procedure when internal treatment has proven useless. This operation consists of appendicostomy, stitching the stump of the appendix to the abdominal wall, by which free irrigation can be performed through the entire colon to the anus.

Since the teachings of Lane have become widely diffused, *intestinal stasis* has taken on a new significance. Various efforts have been made to overcome this by anastomoses of the intestinal tract.

Bainbridge reports one hundred and six cases of intestinal stasis in which the operation of ileosigmoidostomy or colostomy was performed. Four cases died from the operation, so that the mortality is not a negligible quantity.

Strauss recommends for chronic ulcerous diseases of the lower colon an artificial anus, either at the cecum or, in case the whole colon is affected, at the lower end of the ileum. This method is superior to the employment of irrigation from above.

Goebel advises, when persistent and severe constipation persists, after the diagnosis is established by the x-ray of either congenitally enlarged sigmoid or the presence of a rectal valve, that one should first try hormonal injections. If these are insufficient, an excision

of the valve should be performed, or, if an enlarged sigmoid exists without valve interference, resection should be employed. If, on the contrary, with the enlarged sigmoid a valve is found, the valve should first be removed. When cecum mobile is present, suspension should be attempted, and, if this is impracticable, a portion of the cecum should be excised.

Hedlund reports four cases of megacolon which were treated surgically with resection of the distended intestinal portions with or without a preceding establishment of a preternatural anus. He has observed these cases both immediately after the birth of the child as well as in youths and not seldom in adults. The condition is probably congenital, or brought on by a twist of the sigmoid or of the abnormal length of this portion of the intestines.

Cysts and diverticula of the colon are often the object of surgical intervention, as they obstinately persist in spite of medical treatment.

Marchetti reports a successful operation for a cyst of the transverse mesocolon. The operation consisted of extraction of the cyst, which was followed by perfectly normal postoperative convalescence.

Brewer reports a case of acute inflammation of a diverticulum of the sigmoid flexure. This case had been previously operated for the same disease. In the lower left abdominal quadrant there was a swelling, which was painful on pressure, and there were also fever and severe abdominal pains. The swelling increased steadily in size and sensitiveness. Operation showed a diverticulum that was inflamed and contained pus. The patient eventually recovered.

Neupert reports two operated cases of intestinal diverticulum. The first, a diverticulum of the sigmoid flexure, had extended to perforation and abscess formation, of which the outcome was death. In the second case there was a diverticulum extending from the transverse colon, which was first operated on for removal of the distended portions, and, as this was ineffectual in relieving the symptoms, the whole ascending and transverse colon was removed and the ileum united with the descending colon. Convalescence was promptly established, with the normal intestinal functions.

Hernia represents another form of disease in which we have to seek the assistance of the surgeon. Many cases progress comparatively well for years with trusses and other apparatus, but we are frequently called on where strangulation has taken place and where operative intervention must be immediate.

Riedel declares that in hernia the presence of intestinal coils exists much oftener than is supposed. The diagnosis in inguinal and femoral

hernia is difficult only when a small portion of the intestine is incarcerated and the patient is indifferent to pain. All efforts at manual reposition are contraindicated and the rupture must be operated immediately.

Szuman has operated seventy-eight inguinal herniæ in sixty-one children, of which two were incarcerated. There was no fatal termination. Recurrences took place in two cases. An early operation is strongly recommended on account of the danger of a permanent hernia. He further concludes that the wearing of a truss is not always harmless.

Van Assen, basing his experience on one hundred cases of strangulated hernia, draws the following conclusions: Every strangulated hernia should be operated immediately, without any effort at manual replacement. In the presence, however, of active syphilis, and an infection of the operation field, it is perhaps advisable to employ manipulation, unless no special contraindication exists. With little children, when no general symptoms are present, it is very often possible by simply raising the hips to cause the strangulated portions to spontaneously make their way back into the abdominal cavity. The strangulated hernia should, in general, be operated by means of local anesthesia.

Eichner strongly recommends operation for umbilical hernia, which should be accomplished in the following stages: first, resection of the sac; second, insertion of a pursestring suture throughout all the layers of the tissue surrounding, including the skin, outside the location of the wound; third, union of the edges of the hernial opening; fourth, drawing together the pursestring; and fifth, union of the skin.

Cepella calls attention to the fact that whenever a hernia of the linea alba, associated with gastric symptoms, is simply closed by suture without exploratory laparotomy, the results are usually very unsatisfactory, for under the simplest hernia severe gastric disease may often lie concealed. The recurrences of the simple hernia after operation were comparatively large—12 per cent.

While operations for *gallbladder diseases* cannot strictly be regarded under those of the digestive tract, still, gastric symptoms, such as eructations, vomiting, etc., so frequently depend on the gallbladder affection that they apparently come under this head.

Whether due to stones or inflammatory affections of the gallbladder, by which we have produced a viscid bile, causing great discomfort, if not actual pain, after a preliminary course of dietetic and medicinal treatment, there is nothing left for us but to seek the aid of the sur-

The surgical procedure may be either cholecystostomy with drainage, or cholecystectomy, or simply the removal of the obstructing stones from the duct, yet it is surprising after such operations how quickly the former gastric symptoms subside, often to remain absent permanently unless a reinfection of the gallbladder occurs.

Such operations, too, in our experience have always proven very harmless, when fever and jaundice are absent, as far as the termination of life is concerned, and there are no other means known to medicine, according to our opinion, by which such results can be procured.

A similar condition is present, too, in attacks of acute pancreatitis or pancreatic hemorrhage—the latter a most fatal condition, in which immediate operation forms the only means of saving the patient's life.

Hemorrhoids and anal fistulas, after a moderate attempt at treatment by means of suppositories and rectal irrigation has been made, are properly within the province of the surgeon, and particularly in elderly people the operation must not be delayed until carcinoma replaces the previous simple inflammatory affection.

PART II
SPECIAL GASTRIC DISEASES

CHAPTER IX

ACUTE AND CHRONIC GASTRITIS

ACUTE GASTRITIS.

Causes.—The causes of this disease may be divided into primary and secondary, of which the former comprise the ingestion of spoiled or improperly prepared food, or, as has often come under my observation, instances where gross and rapid eating are indulged in for a certain period (weeks or months), when the stomach rebels and a "biliary" attack—or, in other words, an attack of gastritis—occurs. Many of the attacks of ptomaine poisoning occurring in summer are only a gastritis brought on by eating food which has not been kept fresh by ice, and sometimes one must acknowledge that the food is probably unjustly accused and the indisposition brought on by the incessant drinking of ice water, as these attacks are most liable to occur during the excessively hot weather. Closely allied to this form of gastritis is that brought on by continued use of toxic substances, strong acids, alkalies, alcohol, purgatives, and especially the mineral poisons used medicinally, as arsenic (Fowler's solution) and phosphorus.

Secondary causes of acute gastritis are nephritis and gout (stomach gout of the English), infectious diseases (measles, scarlatina, erysipelas, and pneumonia). In this form, however, the gastric symptoms are overshadowed by the more urgent ones of the disease itself. The "weak" stomach, so-called, with its occasional attacks of indigestion when something perfectly edible "distresses," does not indicate that its owner is in any degree subject to acute gastritis, but is to be classed in the category of nervous dyspepsia, for the attacks rarely last over twenty-four hours, and hence the tendency to attribute the discomfort to the last article eaten.

Symptoms.—The symptoms consist of loss of appetite—in fact, disgust for food—nausea, which may increase until the patient vomits several times, a furred tongue, and a very offensive breath. Increased secretion of saliva and a feeling of pressure in the epigastrium are present, accompanied often by considerable tenderness to pressure,

but actual pain is rare. The vomitus is very acid from fermentation, as the hydrochloric acid is often temporarily suppressed. The urine is high colored, limited in quantity, usually contains urates as a deposit, and may contain a trace of bile, since the duodenum rarely escapes involvement in the process. The bowels are confined, and there is usually no fever. Adults never have any marked temperature with acute gastritis, though children may. When it is necessary for the author to differ with colleagues on the diagnosis of acute gastric catarrh, with the patient's temperature at 104° and no pulmonary symptoms, the next day usually discloses a frank pneumonia.

Treatment.—The treatment consists chiefly in a series of "do nots," for every individual you see with such an attack has had previous ones, and the best cure is the discovery of his particular indiscretion in diet and its avoidance. Particularly in children should one make an effort, for their "weak" stomach, which the fond mother often thinks is inherited, usually turns out to be a much abused organ, and the problem can often be solved by asking the parent to let the child eat in the presence of the physician. The child can often exceed the "famished wolf" in the voracity with which it devours food. With the adult who steadily frequents saloons, an acute gastritis is usually passed him "first over the bars," as a well-advertised whisky has it; not from the inherent harm of a moderate amount of alcohol, but from his repeated attacks on the bottle, resulting from good-fellowship and treating. Allusion has already been made to the fate of our public men who are compelled to frequently attend formal dinners, where six to eight courses are served, the "discussion" of which soon leads to acute gastritis. When we have an infectious disease before us, we must immediately place the patient on the simplest diet in order to forestall and avoid an occurrence of this affection, which adds much discomfort and increased danger to the original illness. The real treatment begins with absolute abstinence from food until the nausea and vomiting cease, and, if the latter is not effective, a gastric lavage or an emetic is indicated to free the stomach from all fermenting remnants of food. The emetic had best not be given by the mouth, since it aggravates the irritation of the stomach, but a hypodermic should be employed, consisting of apomorphine hydrochloride, 0.006 gram ($\frac{1}{10}$ grain), which almost every physician carries with him in the form of tablets, easily soluble in water. Many people are able to provoke vomiting by thrusting a finger down the throat or by drinking a little mustard suspended in lukewarm water, but these means produce an unpleasant nausea, which is apt to continue, and do not

empty the stomach completely. It is therefore best, on the whole, to use the tube and to wash out until the wash water comes clear, and it is surprising sometimes to note how quickly the nausea disappears after this act. With small children this is the most effective measure of all, for it often prevents the subsequent involvement of the intestine so provocative of the much dreaded cholera infantum. If nausea continues after the stomach is freed from débris, bits of ice may be given or cocaine hydrochloride, or it may sometimes be necessary to give morphine sulphate, 0.015 gram ($\frac{1}{4}$ grain), hypodermatically to stay the "dry heaving," as the clinic patients call it. Medicinal treatment for the gastritis itself is rarely required, but, if there is much acid eructation after the vomiting has ceased, we may employ either of the following:

R	Resorcinolis	2.0 or $\frac{1}{2}$ dram
	Magnesii oxidi	20.0 or $\frac{2}{3}$ ounce
M.	Fac in chartulas XX.	
Sig.: One powder every two hours.		
R	Resorcinolis	0.5 or $7\frac{1}{2}$ grains
	Aqua chloroformi	100.0 or 3 ounces
M.	Sig.: Tablespoonful	every two hours.

Diet.—The diet for twenty-four to forty-eight hours should be confined to albumin water, or, unless the patient demands some nourishment, complete abstinence for this period is most desirable. This is most difficult to carry out in children, for the mothers imagine that such treatment is brutal, and cannot understand that forty-eight hours' abstinence from food under such conditions does not produce the pangs of hunger. The child feels uncomfortable, and often demands food because it imagines its discomfort is due to hunger. Thirst may be gratified by small quantities of cold Vichy water (a wineglassful), for, if larger quantities are taken, vomiting is liable to occur. The coated tongue may be frequently sponged with the diluted antiseptic solution of the Pharmacopeia, or with lemon juice, as Zweig recommends. As soon as the earlier symptoms disappear, which rarely last over forty-eight hours if these directions are followed, or as soon as hunger reappears, we may give the patient cooked and cooled milk (modified by tea or coffee), lemonade, bouillon, pressed beef juice from meat previously broiled, or gruel made from the various grains—barley, wheat, corn, or rice flour, strained—or gelatine. If no untoward symptoms occur, we may go on to dropped eggs, boiled lean white meat of chicken, raw oysters, and broiled steak: the latter chewed and the juice swallowed, but the fiber rejected. These, with

cream, will usually satisfy the patient for eight to ten days, and not until then should he return to his previous manner of living, though cabbage, beans, pease, and uncooked fruit had best be avoided for some time longer. This usually ends the attack; but sometimes the noxious material enters the intestine, and then we have gastroenteritis, with colicky pains and several foul-smelling stools, often in a state of active fermentation. In this case the diarrhea should not be checked at once, but encouraged by calomel in small doses, 0.006 gram ($\frac{1}{10}$ grain), frequently repeated, or by castor oil, though the latter is usually ejected by the irritated stomach. A teaspoonful or two of Carlsbad salts, given in a cup of very hot water (not warm water), will sometimes be retained and produce the desired result. The rectal injections usually fail to correct the condition because they wash out only the lower bowel. If loss of appetite continues, we may often overcome it by 10 drops of dilute hydrochloric acid, well diluted, taken *after meals*, because, if taken before, it may cause pain by acting on the scarcely restored mucous membrane. Pain is rarely present, except when the bowel is also affected, and, after free evacuation, opium should be given by suppository rather than by mouth as extractum opii 0.03–0.05 gram ($\frac{1}{2}$ – $\frac{5}{6}$ grain), to be repeated only when the pain is severe. The sense of pressure and fullness over the epigastrium may be allayed by mustard leaf or cold compresses. The restriction of the term acute gastritis to those forms resulting from violent mineral poisons is ill advised, but, after the antidotes have done their work, the treatment of the resulting condition does not differ from that given above. The phlegmonous gastritis, on account of its difficulty of detection, rarely, if ever, presents itself for treatment, but, if it does, surgical intervention offers the only hope.

CHRONIC GASTRITIS.

Causes.—The causes which produce the acute form may by longer continuance cause the chronic variety after several acute attacks.

Primarily, we have only a repetition of the causes producing an acute attack, but alcohol and purgatives seem to claim an equal number of victims, but not in the same sex. Furthermore, the constant use of condiments and tobacco may lead to chronic gastric catarrh, as it is often called.

The secondary causes of this disease are gastric cancer and ulcer, dilatations due to pyloric narrowing, as well as sometimes pure atony and venous congestion of the gastric walls from old cardiac disorders.

Chronic gastric catarrh often arises from cirrhosis of the liver and emphysema of the lungs for the same reason—impairment of the venous circulation. Pulmonary tuberculosis, too, is a very common cause of gastritis, and some enthusiastic workers in the line of gastric disorders make this diagnosis, only to have their attention called to concomitant apex consolidation, which antedates the “dyspepsia,” as the patient calls it. In fact, the pretubercular stage of phthisis, as it is sometimes termed, is ushered in by marked evidence of achylia and gastritis. Parenchymatous nephritis also goes hand in hand with a gastric catarrh, which is also true of diabetes, whether from the disease *per se* or from the enormous quantities of meat that is to be eaten. There is often an association between pharyngeal and nasal catarrh and gastritis, but whether accidental is difficult to say. Many claim that swallowing the mucus and pus of the former brings on the latter. In these instances there is marked *fetor ex ore*, which does not come from the stomach, as the patient claims, and must always arouse suspicion of antrum disease. If found and relieved, the gastric trouble usually subsides. There is also a close association between arteriosclerosis and gastritis, from which come often the sharp hemorrhages from patients suspected of cancer, but living many years after.

Symptoms.—The symptoms divide the disease into three stages: (1) gastritis acida, resulting from a too great use of alcohol, condiments, and drastic laxatives, where there is always a hypersecretion; this passes gradually into (2) gastritis anacida, in which the hydrochloric acid is lost, while pepsin and rennin are still present, though in diminished amounts; after long continuance of this condition the disease reaches the last stage (3), complete achylia gastrica, in which both acid and ferments are absent and the peptic glands are destroyed by atrophy. All of these stages are associated with abundant mucus, so that we may say, “No mucus, no gastritis,” but, as described, the mucus must be demonstrated to come from the stomach and not by any means from the mouth (saliva). The subjective symptoms are usually not characteristic of this condition; in fact, may be latent until an accidental examination of gastric contents shows irreparable mischief accomplished. The appetite is erratic, demanding foods higher seasoned and salads with abundance of vinegar, mustard, and pepper. A “dark-brown taste” on rising is common, and patients complain of “water brash.” After food is taken, epigastric fullness and pressure are complained of, and, if no gastric juice is secreted, patients complain of occasional lancinating sharp pains. Desquamations

of the gastric mucous membrane also occur, which aggravate the pain and give it the specific name of *exfoliativa* or *erosiva*, which places it midway between a *gastritis* and an *ulcer*. "Heartburn" and acid eructations are also present, but nausea and vomiting occur less often. Hard drinkers have the morning vomiting, which may be only the pharyngeal mucus which is swallowed during the night, or, in our opinion, may not come from the stomach at all, but be brought from the nasopharynx by a pseudo act of vomiting, for we have never been able to obtain any morning residue from these patients with a tube. Vertigo, palpitation of the heart, and even a true asthma may arise. The spirits of the patient are low, and he has many ungrounded fears, such as entering a building where a public gathering is assembled or the rear car of a train; these latter are not peculiar to this disease, but associated. The intestinal functions are also disturbed as a probable result of catarrh, for diarrhea is common, while constipation is rare. Objectively, one can usually find a diffused tenderness over the epigastrium, but no painful points; the tongue, on account of the existing pharyngitis, at its posterior portion has a thick grayish-white coating; the teeth are usually poor and the molars may be entirely wanting, which presages poorly masticated food for the stomach's manipulations. The examination of the gastric contents, however, gives us the chief points for a diagnosis. We find abundant mucus in the form of long shreds and transparent lumps, while with the microscope these are found loaded with leucocytes. Sometimes as much as 100 c.c. of a secretion, largely mucus, can be obtained from the fasting stomach without a trace of free acid, a condition called *myxorrhea gastrica* by Kuttner. The behavior of hydrochloric acid and ferments has been mentioned. The motility is usually well maintained; in fact, the radiologists tell us that hypermotility may exist, but evidence derived from the small portion obtained after a test breakfast is not trustworthy, and, as explained, usually rests on the thickened consistency of the fluid, due to scanty secretion of gastric juice, which will not allow the former to flow through the tube. The rapidity with which the undigested food passes into the intestine has been offered us as an explanation of the often concomitant catarrh of the small intestine. Einhorn found often small fragments of mucous membrane in the wash water of these cases, accompanied by eructations, by diminished hydrochloric acid secretion and increased mucus formation, and would make of them a distinct disease, but this is untenable, as they are all manifestations of chronic gastritis. These desquamations, however, are not spontaneous, but are fragments torn

off by the tube, as the interior of the stomach is very vulnerable in this disease, and the presence of these fragments forms an important point in differentiating it from a purely functional suppression of gastric juice of nervous origin.

Treatment.—The treatment—like Dr. Holmes' suggestion, that, to make a gentleman of a boy, you should begin with his grandparents—should begin before the disease appears. This suggestion, however, valuable as it is, is difficult to apply, for the public man will continue to devour his two or three formal dinners a week, followed usually by an after-dinner speech; the business man will gorge himself on Sunday, his only day at home; and many a working man is rarely able to reach his home without leaving a goodly portion of his weekly earnings at the saloon. My lady will lead her sluggish life, driven about in a limousine, striving to suppress the fact that her indolent life is adding steadily to her weight and necessarily to the destruction of her much prized form, and then have recourse to someone's after-dinner pills, until her stomach is, as one such called it, "a boiling cauldron." When told what had happened and why, almost every patient remarks, "I thought that was the cause of my illness, but I had not the self-restraint to resist." These primary "gastritides" usually require only a regulation of the diet, by which laxatives may usually be given up, though it must be acknowledged that many cases require the most infinite patience on the part of the physician to finally eradicate the habit of their use.

The secondary type is, of course, dependent on the primary disease, which is often incurable (heart lesions, cirrhosis of the liver, and pulmonary emphysema) and is very resistant to treatment. Rest in bed and digitalis will usually relieve the first class, sodium phosphate and Carlsbad salts the second, while change of climate, if possible, and iodides will relieve the third class somewhat.

Diet.—The diet must vary in accordance with the character of the secretion. If hydrochloric acid is largely suppressed, we must rely almost wholly on the carbohydrates, and to a much lesser degree on fats and protein. On account of the inability of the gastric juice to digest the gluten inclosing the starch, all these grains and vegetables should be thoroughly crushed and well cooked. We have an endless supply of this group in the innumerable breakfast foods—wheatena, corn flakes, puffed rice, etc.—which, served with sugar and cream, or, better, with salt and cream, form the chief ingredient in the dietary. Vegetables, to which butter is to be added freely—or, better, served in purée form—chopped spinach, mashed potato, squash, and turnip,

as well as pea purée, with cauliflower and asparagus tips, are indicated. Red pepper and paprika can be used freely on the principle that the "hair of the dog will cure the bite," since overstimulation of the peptic glands by condiments has been partially responsible for the condition. If hydrochloric acid and ferments are diminished, meat is not well borne, and should be given in the best divided form, as minced beef, chicken, lamb, fish, etc., all forms of hash and the interior of sausage, if not too fat, like Frankfurters. Pigs' feet and calves' foot jelly, eggs cooked in any form but fried, oysters, and the mild cheeses will usually furnish enough protein material for the individual in the most assimilable form. Somatose and laibose, as illustrations of the predigested protein foods, may be employed in bouillon, or spread on bread and butter sandwiches. Fat can be employed in the form of cream, taken on the breakfast food, freely, in tea and coffee, with limitations mentioned later, salted on baked potato, or sweetened on stale bread, but not drunk except diluted largely with milk, for it often causes unpleasant eructations. Butter may also be employed, but special precautions must be taken that it is not in the slightest degree rancid. During the hyperacid stage, however, coffee, as well as pepper, had best be avoided. Cocoa, particularly the digestible variety, is better adapted. Where constipation is present, buttermilk prepared with lactone tablets (forty-eight hours in winter and thirty-six in summer) can be taken to advantage, and its effect increased by adding to each glass a tablespoonful of milk sugar. The following articles are strictly contraindicated: salted, smoked, and pickled herring, caviar, and anchovy. Sodium chloride undoubtedly causes the secretion of gastric juice in small doses, but suppresses it in large, according to Bickel. Food had best be taken in three meals, which must never be hurried, provided that motility is impaired. These general principles, arranged in the form of a diet list, are here given for those cases where the disease has advanced to marked diminution of gastric secretion:

DIET LIST IN CHRONIC GASTRITIS WITH DIMINISHED SECRETION.

On rising.—A cup of hot beef tea, made with Liebig's or Armours' preparation.

Breakfast.—A glass of orange or grape fruit juice; a saucer of some well-cooked cereal, except oatmeal, with middle heavy cream, but no sugar; soft boiled or scrambled eggs, or some crisp bacon with a baked potato; plenty of toast or crisp stale rolls, reheated, well but-

tered; and some cocoa or broma or coffee, with cream, but no sugar, though saccharine may be used for sweetening.

Dinner.—Soup, not too fat, with barley or rice; Hamburger steak, or the inside of Frankfurter sausage, or fish hash or meat hash, or minced chicken or lean ham; mashed potato, squash or turnip, cauliflower cooked with cream, chopped spinach, or well-cooked rice; gelatine flavored with fruit juice, or cooked or canned fruit, without sugar, but with cream; rice, tapioca, sago, or bread pudding; a little sherry, or whisky, or brandy and water, to be taken after the meal is eaten (sherry wine preferable). Red pepper to be used freely on meat or fish food.

Supper.—Toast or stale rolls, with butter, cream or mild factory cheese, bowl of custard; pigs' feet not pickled, or picked or broiled fish, with the exception of mackerel or halibut. Wine, whisky, or brandy and water after meal.

Avoid all iced drinks or foods, drinking with meals, rapid eating, eating when unduly tired (rest ten minutes before the meal), sweets, or a large amount of fats other than cream and butter. All food is to be well salted.

Many recommend gastric lavage, with sodium bicarbonate (10 grams to the liter) or liquor antiseptics alkalinus (a tablespoonful to a quart) added to the wash water, with the thought of removing as much as possible of the attached mucus, but our experience offers but little hope of accomplishing this purpose unless there is stasis, and in secondary gastritides, due to heart lesions and emphysema, the process is very distressing to the patient, if not dangerous. This lavage is best carried out in the morning, so that the new day may begin with the stomach free from debris. Both in the superacid and anacid stages of the disease, mineral waters have had a vogue. For the former we use Carlsbad, and for the latter, Kissingen, both found in the Newer Formulary and made artificially by the pharmacist, which can be taken at home; or, for the people of means, drinking the waters at the springs adds to effecting a cure the special advantages mentioned in Chapter VIII on treatment. In inacid gastritis the homely remedy, of drinking a half teaspoonful of cooking salt in a cup of hot water, sipped slowly, has accomplished much in controlling the early morning vomiting of the chronic toper; it is to be taken, if possible, before rising. When the gastric secretion is impaired or suppressed, the bath spray, alternating between extremely hot and extremely cold water, and applied to the epigastrium, aids somewhat in arousing a

flow of gastric juice, which manifests itself by an increasing appetite. Medical treatment consists largely in trying to replace the lost gastric juice and improving the motility where it fails. For the former purpose, nothing aids more than 10 drops of dilute hydrochloric acid taken in a glass of water, part before and part after the meal, through a tube. For the well-to-do, acidol and acidol pepsin, a tablet in a wine-glass of water after each meal, works well. Another advantage of this treatment bears repetition, and that is that acid medication also arouses the pancreatic juice, which must vicariously assume a part of the duties of the stomach. Where it is found after a time that the acid has not returned to the stomach, a trial may be made of pancreatin if given in keratin capsules of 0.5 gram just before a meal, but in our experience it is difficult to obtain more than 0.06 gram in the stock capsules, as druggists are averse to making them up. Hence pankreon, in spite of its cost and sometimes the difficulty in procuring it, has become our mainstay, and capsules (0.5 gram) given just before meals form an efficient service. On account of the lack of appetite, a bitter may be added to the acid to advantage, the following prescription is to be recommended:

R Acidi hydrochloridi diluti,
Tincturæ nucis vomicæ, aa.....15.0 or $\frac{1}{2}$ ounce
M. Sig.: Twenty drops in a glass of water before and during the
meal through a tube.

Fluid extract of condurango may also be tried in doses up to a teaspoonful in water before meals, but arousing an appetite by means of drugs is often almost a hopeless task. Where there is a foul breath, rinsing the mouth every morning with hydrogen peroxide often allays the difficulty for the day. Where there is much acid eructation, magnesium oxide can be employed as a powder in gram doses. As the powder is harmless, it may be given in bulk to the patient, and he may take enough to neutralize the acidity of his stomach. Pain is rarely a prominent feature, but, when present, can be controlled by anesthetin, in doses of 0.2 gram (3 grains) in capsules two or three times per day, or often enough to keep the pain under control. Patients must be fully warned against the use of laxatives, and, if with the diet the bowels still fail to move, the only thing that can be allowed is purified liquid petroleum and enemata.

CHAPTER X

GASTRIC ULCER

The causes of gastric ulcer, sometimes called peptic and round ulcer, have been largely discussed, and perhaps three have been fairly well established:

1. Embolism of an artery, which, because it is a terminal one, causes all circulation to cease and allows the gastric juice to digest out that part to which the terminal arterioles reach. These emboli are supposed to be caused by toxic or infectious agencies which enter the circulation, as sometimes occurs in pyemia, and particularly after several large burns of the skin.

2. An increased amount of hydrochloric acid is usually found in the stomach of those suffering from ulcer, existing as a hypersecretion, though recently this excess of gastric juice has been regarded as a result of ulcer and not a contributory cause; nor is it invariably present, as some report true ulcers with diminished or even absent hydrochloric acid.

3. Small hemorrhages from the mucous membrane surface of the stomach, caused by trauma, by the irritation of articles of food too hot or chemically corrosive, or blood vessels ruptured by intense vomiting. It is one of the most common of gastric diseases, and is found much oftener in women than in men, usually stated in a ratio of 2:1. As to age, ulcer in women is most often found between 20 and 30, while in men it may occur between 30 and 50 years. Under 10 years of age, children are rarely found to have ulcer. The disease is prevalent in those regions where hypersecretion is more common, and that usually coincides with localities where the use of meat and condiments prevails. Occupation was supposed to play some part, as cooks were much oftener attacked than others, but Zweig has pointed out that as a class they seek the hospitals and clinics more frequently than any other, and hence swell the statistics. Furthermore, Cohnheim thinks there is much greater prevalence of this disease in cobblers, who bend to their work, often pressing a shoe against the epigastrium as they labor. Also those who wear belts and corsets are more prone, as a class, to this disease on account of the constant pressure over the

upper abdomen. The association of blows with the origin of ulcer may be doubted by some, but very intimate relations exist in some instances, as in the case of a woman, which aroused our interest, who was thrown against a car seat in front of her, striking her upper abdomen. Vomiting of blood followed on that same night and she rapidly succumbed to gastric ulcer. The reply could be made that she had the disease when the accident happened, but this is hardly tenable when we learn that no gastric symptoms had ever occurred before the accident. From the circulatory disturbances come the often repeated gastric ulcers of the arteriosclerotic men between the ages of 40 and 50. In chlorotic girls, suffering from *habitus enteropticus*, the vessels are very narrow, thus predisposing to more ready occlusion and, on account of the character of the blood, to mucous membrane necrosis. This is still further emphasized by Stiller, who found an unusual frequency in the combination of *gastroptosis* and ulcer explained by the narrowed vessels and by the readiness with which a ptosed stomach favors mild stasis and hypersecretion. Another frequent combination is ulcer and tuberculosis for, as is well known, the possessor of the latter disease often has the *habitus enteropticus* in its most exaggerated form. Of noxious substances with causative influence, we may mention alcohol, for ulcer is especially common among chronic drinkers, particularly those in our mind who are accustomed to take one or two drinks to arouse appetite. Furthermore, there is such a close association between extensive burns and ulcer that we must recognize toxic substances produced by the former as instrumental in inducing the latter. There can be but little doubt, too, that the irritation of the vagus nerve, a condition known as *vagotonus*, may be a strong causative agency in arousing ulcer. Notwithstanding a newer compilation of statistics shows that only one-third of the cases of ulcer have hypersecretion, it behooves us, whenever the latter is found, to look carefully for an ulcer, since many a case of long-drawn-out hypersecretion has turned out to be associated with a gastric ulcer. For years we have been demanding either copious *hematemesis* or *gastric stasis* to make the diagnosis of ulcer, while now we are beginning to realize that the hemorrhage may be so slight as to deserve the term "occult," and stasis may not occur, though operation shows well-marked ulcer.

Symptoms.—The symptoms are varied in intensity and frequency, but the most common and persistent is pain. This occurs fifteen minutes to one hour after food is taken, is burning or colicky, and is much worse after solid food than after liquid. Some patients declare

that the pain is worse when lying on the right side than on the left or on the back; some insist that walking brings it on, but it ceases on lying down; while others declare that talking rapidly or becoming excited by increasing the excursions of the diaphragm aggravates their distress. The pain is usually localized by the patient just below the breast bone, but may be under the sternum, or under the left costal border and extend to the left scapula region. It may be so intense that in women the corset must be removed and men have to relieve the pressure of their belt if one is worn. At the height of the pain, vomiting may occur, which causes the attack to cease for the time being; the vomitus is extremely acid, and some declare corrodes their teeth; blood traces may be found, or vomiting may sometimes continue until an ejection of fresh blood may occur, or, as occasionally happens, extensive bleeding takes place during sleep and the patient is aroused only to eject a large quantity of reddish-brown, partially digested blood. The appetite is usually retained; in fact, may be so excessive that "ox hunger" results. Usually, however, from fear of pain, little food is taken, and the ulcer patient is generally very thin, almost emaciated. The bowels are usually confined, but may be normal; the feces often contain traces of digested blood, detected only by chemical means; less often the tarry stools occur where hemorrhage has been copious. It is stated that careful chemical examination will disclose traces of blood in the stool or vomitus in 30-74 per cent of cases of ulcer, so that this fact forms a great aid to the diagnosis.

Among the most valuable objective symptoms are the pressure points, as described in Chapter III under Examination of the Patient. The epigastric one is usually the most circumscribed, and one rarely fails to observe the look of pain on the patient's face when it is pressed or tapped with the percussion hammer. The dorsal point or points are not so well restricted; in fact, Seidl, in a careful investigation of the subject, learned that they might be found anywhere from the junction of the tenth to the second rib and on either side of the spinal column, dependent on the position of the ulcer in the stomach. What he did emphasize most emphatically was their aid in differentiating between functional dyspepsia and true ulcer. The cause of this pressure point has never been fully defined, but, since the mucous membrane of the stomach is so lacking in sensation, a perigastritis at the site of the ulcer will explain this tenderness. The pain experienced may, of course, come from the ulcer, cholecystitis, or gastrophtosis, and one of our most difficult duties is to disentangle the jumble of symptoms, some related and some not, which patients pour into our ears.

In favor of ulcer is the pain after eating, more severe after solid than liquid food; stronger when the patient is on his feet than lying down, occurring daily for weeks, and the stool containing chemical blood. For cholelithiasis the strongest points are attacks of pain at night or when the stomach is empty, and long periods of complete freedom from discomfort; pain, in the classical description, starts from the right costal border and extends to the back, but in reality it is often complained of in the median line; enlarged liver and icterus are present when the common duct is occluded, but many an attack pursues its course without either, for the stone may be in the cystic, or there may be no stone whatever, but inspissated bile and tenacious mucus, which cause the colic. Food, position, or exercise have no influence on the attack. Gastroptosis as a cause for the pain is indicated by the absence of influence in the kind of food, by relief when the patient lies down, or when the abdomen is supported by a well-fitting belt, and by the visible pulsations of the aorta, as well as by the absence of blood in the feces. It has been stated that the presence of a pressure point at the *right* of the spinal column, at the level of the tenth to twelfth rib, speaks for cholelithiasis, but the findings of Seidl, mentioned above, rather shatter this distinction. "Occult" blood can be found in the gastric contents, but, as mentioned, on account of the ease with which the tube may cause small erosions with bleeding, one should always rely on the stool for this test. An excessive percentage of hydrochloric acid in gastric contents has only a limited significance in ulcer, but a continuous secretion—that is, the findings of 50 c.c. or more of almost pure gastric juice in the fasting stomach—with a high hydrochloric acid content (40 and more is not uncommon in our experience), is most suggestive of ulcer. Hypersecretion determined in this way is almost invariably the consequence of the ulcer when no food fragments are present. The detection of microscopic stasis after an evening Riegel meal has proved less reliable in our hands, and, when operation has been undertaken for ulcer based on this and the increased acidity due to hydrochloric acid after the test breakfast, the surgeon has reported no lesion. Theoretically, when the ulcer has cicatrized, the stomach wall at the site has lost partially its motility and slight stasis follows. Strauss gives 2 grams of bismuth and looks for the retention of some of it in the wash water, and Kaufman puts much dependence on the absence of mucus in the gastric contents. In our opinion the presence of bile in the contents after a test breakfast, but not in the fasting stomach, is very significant of chronic ulcer at the pylorus, because the latter does not close completely under these

conditions. Among the general symptoms which attract attention are the evidences of anemia and emaciation, the result of insufficient nutrition and minute hemorrhages from the lesion. The long suffering, too, from the ulcer produces a chain of neurasthenic symptoms, so that it is often difficult to separate the organic disease from a functional dyspepsia. These nervous symptoms also persist a long time after an operation for ulcer, and often cause the physician to despair of relief to the patient, but later the former regains his nervous tone.

One of the most common complications is gastric dilatation, which may be variable when largely due to pyloric spasm, so that retention may be found over a longer or shorter period, after which it disappears under treatment. Whether the ulcer at the pylorus really heals is difficult to say, but at least the relief is not permanent, and sooner or later stasis recurs; or there may result actual stenosis from scar tissue, when gastric dilatation and stasis become steadily progressive until visible peristalsis of the stomach can be seen through the abdominal wall after every meal.

Another common complication is perigastritis, an extension of the ulcer to the peritoneum and the union of the stomach with other organs. These adhesions produce the most bizarre symptoms, boring sensations deep in the abdomen, cardialgia after a full meal, pain in the epigastric region just before or during stool, and sharp pain with rapid and deep inspiration. Unless some marked anomaly in the percussion outline of the stomach is discovered, a diagnosis can be made only by exclusion. Strange to say, relief can sometimes be obtained by gastroenterostomy, when adhesions themselves are undisturbed.

The most dangerous of all symptoms is a perforation, by which the peritoneal cavity is filled with gastric contents and blood clots. This may sometimes happen, as surgeons at hospitals who do much emergency work assure us, without the slightest warning in the way of previous symptoms. The patient is in agony, complaining that something is tearing his abdomen, the face is drawn and pinched, the temperature is subnormal, and collapse ushers in the fatal termination. Vomiting is rare, the abdomen is canoe-shaped, the region of the epigastrium hard and rigid, liver and spleen dullness are obliterated, and soon fluid begins to accumulate in the dependent portions of the abdomen if the victim lives long enough. When adhesions have taken place previous to the rupture, the general peritoneum is protected, and often a well-circumscribed cavity is found containing the same elements which sometimes become purulent. If the perforation is into a neighboring organ (liver or pancreas), that may become par-

tially digested, and the x-ray will show an indentation filled with bismuth after the Rieder meal. Fortunately, fatal hemorrhages are only rarely complications of ulcer, and occur in about 1 per cent of the cases under observation. Generally, there occurs only a moderate hemorrhage, which stops of itself, and the patient recovers rapidly from the great loss of blood; still, cases do occur of severe hemorrhage which demand operative intervention. Rarely a chronic ulcer leads to the formation of scar tissue which can be detected by palpation. Such ulcer tumors (if we may call them so) are often very difficult to distinguish from a carcinoma. If the tumor persists longer than three years, and if free hydrochloric acid can be discovered, this speaks distinctly for a benign tumor. Perigastric adhesions and spasm of the pylorus are also felt as rigid tumors, though such an event is of rare occurrence.

A much rarer complication of ulcer is the hourglass stomach, which arises from an ulcer lying between the cardia and the pylorus, whose scar by contraction divides the stomach into two parts. The diagnosis of the hourglass stomach is extremely difficult. Sometimes we may detect it by the peculiar percussion outline of the inflated stomach; at other times, when we imagine that we have entirely emptied the stomach with lavage, there will come a gush of fluid heavily loaded with food fragments. Of course the surest way to diagnose this condition is by means of the x-ray.

The most important, however, is the part that chronic ulcer plays in the causation of carcinoma. The diagnosis can often be made after long observation and frequent examination of the gastric contents. A carcinoma which has its site upon an ulcer scar is distinguished by the fact that for a long period free hydrochloric acid can be detected, though the amount grows steadily less and less with the growth of the carcinoma until it finally entirely disappears in order to give way to a large amount of lactic acid, which then firmly establishes the diagnosis. There occurs to us at least one case in which free hydrochloric acid and *sarcinae ventriculi* persisted for a long time, the latter also readily discoverable in the feces, but eventually the hydrochloric acid disappeared, while the same vegetation was found with scanty lactic acid bacilli, which, in turn, gave way to an abundant growth of the latter bacilli. It was only by a successive series of the examination of gastric contents that this chain, from what was apparently first benign to what an autopsy proved to be malignant, was followed.

Treatment.—The treatment of ulcer can begin only after the affec-

tion is established, since, as we do not know its cause, we can offer no suggestions as to prevention. Still, we may do something to avoid it by paying attention to those conditions which accompany it, even if we cannot prove them to be its cause. Among these means belongs, before all, the control of the hypersecretion, which, as stated, interferes very emphatically with the healing of the ulcer. At the same time we must also oppose vigorously chlorosis and anemia, since these two conditions furnish very disadvantageous features for the control of the lesion. Here, however, we have to stop and acknowledge that there is nothing else that we can do to prevent an ulcer. In real treatment we are dealing with three different conditions, which demand, of course, distinct forms of treatment: 1, hemorrhagic stage, which may be regarded as its acute form; 2, the conditions present in chronic ulcer; 3, the complications and results of the chronic form.

1. The *hemorrhagic stage*, or *acute gastric ulcer*, demands absolute rest in bed for the patient, as well as prevention of any extensive motion, as leaving the bed, or even rising to an erect position for the purpose of passing the stool or urine. All friends and visitors must be absolutely forbidden to talk with the patient, since all forms of mental excitement are liable to increase the blood pressure and aggravate the condition. All forms of nutriment by the mouth are to be strongly forbidden, and even lumps of ice, which have proved so gratifying to the patient, must not be allowed, so that the damaged organ may be kept in a state of absolute rest. All medicinal treatment by the mouth must be avoided, since the absolute freedom from any material in the organ is the best styptic. Through these means alone it is usually possible to check the hemorrhages within the first twenty-four hours. If this does not take place, then we may make use of certain medicaments which have a reputation for checking hemorrhage. The best of these is a preparation of ergot or ergotine, which can be used hypodermatically. A form is put up under the title of "ergot aseptic" in ampules, which contain 1 c.c., an average dose, are sterilized, and can be used directly in the hypodermic syringe. This can be repeated once in an interval of two hours in case the hemorrhage does not cease. In recent times gelatine has also been employed for a hemostatic, and, provided that it is properly sterilized (on account of the unfortunate fact that tetanus bacilli have been found in it), can also be injected directly by means of the subcutaneous syringe. The usual preparation is as follows:

R Gelatinæ 1.0-2.0 grams or $\frac{1}{4}$ - $\frac{1}{2}$ dram
Sodii chloridi 0.6 gram or 10 grains
Aquaæ sterilizatae 100.0 c.c. or 3 ounces
M. Sig.: For hypodermic injection.

Of this 1 to 2 per cent gelatine solution, 80-100 c.c. are to be warmed to body temperature and then injected by means of an antitoxin syringe under the skin of the abdomen. These injections are somewhat painful, and are not, as stated, entirely free from the danger of tetanus infection. Much less harmful is the use of a 20 per cent solution of gelatina sterilizata, which can be employed hypodermatically, and can be used by rectal injections in concentration of 5 per cent to 10 per cent and in amounts of 200 c.c. This latter method of employment has proved very satisfactory to us, and no case has yet arisen where its hypodermatic use was found necessary. A more recent remedy, which may be employed as a hemostatic and has given satisfaction, is adrenalin in 1:10,000 solution, put up in ampules containing the exact dosage of 1 c.c., which is to be injected with a syringe. An injection may be given daily, or we may add 30 drops of the solution to the nutrient enema, or it may be given by the mouth. From the adrenalin alone results have not been so brilliant, but as an addition to the physiologic salt solution, which should always be injected where much loss of blood has occurred, it has proved very efficacious in increasing the blood pressure and checking the condition of collapse. Enemata of ice water also prove very satisfactory, since they reflexly produce contractions of the stomach and its vessels. Boas' suggestion that one give an enema of 10-20 c.c. of a 10-20 per cent calcium chloride solution is a good one and will often prove efficacious, but in the most obstinate cases (luckily few in number) the gelatine solution employed hypodermatically is the last resort. Much less dangerous is the use of gelatine by the mouth, which is also very effective. One should give the patient a tablespoonful of a 10 per cent solution, to which 10 per cent of cane sugar may also be added. The gelatine causes thrombosis of the small vessels and thereby checks the bleeding. Very often the pain and uneasiness of the patient, which cause him to toss about, an act in itself provocative of increased bleeding, must be checked by a hypodermic of morphine to which atropine has been added. The soluble hypodermic tablets containing morphine sulphate, 0.015 gram ($\frac{1}{4}$ grain), and atropine sulphate, 0.0005 gram ($\frac{1}{120}$ grain), are most convenient for use. It is true that morphine increases the secretion, but the atropine usually holds this action in check. Codeine phosphate, which does not possess this dis-

advantage, also will quiet the pain and the patient, but is not so effective as morphine. This also may be given by hypodermatic injection in doses of 0.03 gram ($\frac{1}{2}$ grain), and can, of course, be repeated oftener than the morphine; or suppositories of extract of belladonna, 0.010–0.020 gram ($\frac{1}{6}$ – $\frac{1}{3}$ grain), may be given. If collapse seems imminent, subcutaneous injections of sterilized 0.6 per cent salt solution should be made in the buttocks, and in some cases $1\frac{1}{2}$ liters were introduced in this way by a Potain or antitoxin syringe without much discomfort. This amount has been taken up with surprising rapidity by the circulation, with immediate benefit to the patient, as shown by the cessation of the sighing respiration and the return of color to the blanched face. On the second day after the hemorrhage it is possible to begin the rectal enemata (page 261), forbidding the patient to make any voluntary motion whatever. At first three nutrient rectal injections and one of water for thirst will be sufficient; the latter should consist of 100 c.c. of beef broth, 100 c.c. of 50 per cent cane sugar solution, and 10 drops of tincture of opium. This injection leaves no residue in the rectum, being fully absorbed, and quenches the thirst better than anything else suggested. All forms of alcohol are to be rejected, for it has been determined that all solutions containing 7–10 per cent of alcohol, when introduced into the rectum, increase the gastric secretion. These rectal injections should be continued from eight to ten days after the hemorrhage ceases before we proceed to feeding by mouth. In the meantime a light ice bag should be placed over the epigastrium; it relieves the pain, even if it has no action on the bleeding. Warm applications should not be applied to the abdomen for a long period after the bleeding ceases.

2. The *second stage*, or *chronic ulcer*. Formerly, by adhering closely to Leube's rigid diet, very often the ulcer was cured, but the patient was reduced to a state of emaciation, as in typhoid fever. Now, however, it has been found that the Lenhardt diet, which affords vastly more nutriment, since more concentrated, leaves our patients in a much better condition and undoubtedly hastens the cure, because naturally a healing process will take place much more readily when a patient is in the best possible condition, and no harm has as yet come from this more liberal feeding. The first essential, however, is rest in bed. The treatment should not be begun for at least eight days after a hemorrhage and should continue from four to six weeks.

During the *first week* the diet must consist largely of milk, since it will combine and neutralize a large amount of acid, is nonirritating, and furnishes but little salt from which the economy can make acid.

It is better to cook the milk, remove the scum which rises to the top, and then give it cool or lukewarm, but never ice cold. As, unfortunately, 3 quarts (3,000 c.c.) of the milk must be taken per day to supply the needs of the body, it has been found necessary to fortify the milk, which can be done by the addition of flour or well-cooked Indian meal, 1-2 tablespoonfuls to the cup, making a nutritious gruel; or, what is somewhat more convenient, the addition of a tablespoonful of laibose or somatose. If the patient has diarrhea, we may add $\frac{1}{3}$ the volume of lime water to the milk, of which the patient is not to take more than a cupful at a time. In addition, one can give 2 tablespoonfuls of gelatine, with cream and sugar, twice daily, as well as egg yolks; the egg yolks are to be increased one daily until at the end of the week five are taken, and may be beaten and drunk sweetened, or simply thoroughly mixed with the milk. Very rarely a patient is found who, on account of diarrhea, gaseous distentions, and other evils, cannot take milk at all. Such a one can take three times per day a cup of thickened soup made of chicken broth, 1 tablespoonful of sifted flour, 2 tablespoonfuls of butter, and the yolk of an egg. By means of such a form of nutriment we can fully supply the needs of the patient during the first week without having recourse to milk. To quench the thirst, which is always persistent, we may use albumen water. This is prepared by adding the white of an egg, of which, of course, the yolk may be used in the milk as described, to a cup of fresh or cooked water after cooling and thoroughly stirring, to which 4 teaspoonfuls of sugar are to be added. Certain mineral waters also fulfill this purpose admirably, such as contain very little carbon dioxide, of which the best is Vichy, easily procured at any drug store.

During the *second* week the diet should remain the same as in the first, with the addition of only some zwieback or well-toasted stale bread. During the early part of the second week the zwieback had best be cooked in the milk; later it can be eaten as obtained. It is best to begin with two pieces daily, and gradually increase one piece each day until at the end of a week five pieces are taken.

During the *third* week, as soon as spontaneous pain or pain on pressure has ceased, we may begin with a meat diet. One should first give about 3 ounces of well-chopped or ground chicken, squab, or calves' brain. In the preparation of the calves' brain, most of the connective tissue which surrounds the brain matter should be carefully removed, and the remainder cooked lightly in butter, or made up into a broth, to which flour may be added. The chicken or veal should be passed through a meat grinder, and then cooked and served

as bouillon. It is much better during the first week to give as little salt as possible, and, even later, salt should be used only in very limited quantities as an ingredient of the food served. When the meat causes no discomfort, on the next day the same amount may be given twice, and this may be continued to the end of the treatment. In addition to this, the food given during the second week should be continued as to variety and quantity. The zwieback may, however, be spread thickly with butter, and butter may also be added to the eggs.

During the *fourth* week we may add to the dietary finely chopped beefsteak (from the tenderloin), a little fresh salmon, venison (if it can be procured), finely chopped roast beef, and veal. Fish may be added to the dietary in the form of cod, haddock, and trout, best broiled and well spread with butter. Of vegetables, spinach, squash, and mashed potato, in which butter should be freely used, can be added. Fruit in the form of applesauce or prune whip may also be employed.

During the *fifth* week, in addition to the articles of food already mentioned, we may employ omelet, soft boiled eggs, all vegetables which can be served in purée form, and the interior of rolls.

After two months we may give meat in its natural form (unchopped), the diet otherwise remaining the same. For at least a year one must forbid raw fruit, all vegetables with hulls, ice cream, all very hot or very cold drinks, all alcohol in concentrated form (whisky, brandy), black coffee, sharp condiments, mustard, brown bread, or graham bread. During the first year also the patients must refrain from all strenuous bodily exercise which brings a strain upon the abdominal muscles or associated with pressure upon the same. Among this group belong the raising of heavy burdens, the wearing of a belt, riding, rowing, swimming, and gymnastics. As Oliver Wendell Holmes, in his "One-Hoss Shay," remarks, "there is always somewhere a weakest spot." We must convince the patient that his "weakest spot" is the site of the ulcer in the stomach, and that it is absolutely necessary that he should avoid any strain on that part of his body. This diet, which has been described in full, has been summarized for the benefit of those who would employ it, and is presented in the following diet list:

DIET LIST FOR GASTRIC ULCER (MODIFIED LENHARTZ).

It is absolutely necessary that the patient be kept in bed.

7 a. m.—A half glass of cooked milk, with the leathery substance which rises to the top removed, and the yolk of one egg stirred

into it and sweetened, if desired; taken lukewarm or cool, but never ice cold. This amount to be increased on the second day to three-fourths of a glass, and on the third to a full glass, which is to be continued for the week. If the milk produces diarrhea, add 2 tablespoonfuls of lime water to each portion.

9 a. m.—A saucerful of gelatine (Knox's or Crystal Rock), with 2 tablespoonfuls of cream and a teaspoonful of sugar.

12 m.—A half to a full glass of milk prepared as at 7 a. m., with a tablespoonful of laibose.

3 p. m.—A saucerful of gelatine, with cream (medium) and sugar, as at 9 a. m.

6 p. m.—A half to a whole glass of milk, as before, with one egg yolk stirred in and sweetened. The egg yolks at 7 a. m. and 6 p. m. are to be increased until six are taken daily at the end of the week.

8 p. m.—A half to a full glass of milk, with a tablespoonful of laibose.

The whites of the eggs are to be stirred up in water in the proportion of a white to a glass of water, 4 teaspoonfuls of sugar to be added to every glass, and *only* this to be taken by the patient when thirsty. If the bowels do not move, no laxatives can be taken, but an injection of warm water or a little soap may be employed. If much discomfort is produced by the food, a hot compress must be laid over the abdomen, particularly over the stomach or above the navel.

This has been modified to a certain extent from the original Lenhartz in order to make it more acceptable to our American clientele. In its original form, the Lenhartz diet contains vastly more nourishment than was formerly considered advisable in the treatment of ulcer. He recommends a diet very rich in albumen in order to prevent under-nourishment and at the same time to overcome the hyperacidity. In general, his method of treatment is the following:

The patient must remain absolutely quiet in bed for a period of four weeks, and an ice bag is to remain constantly upon the abdomen. On the day of the hemorrhage the patient is to receive boiled milk in tablespoonful doses amounting to a cupful, as well as one to three well-beaten fresh eggs, during the first twenty-four hours. Bismuth subnitrate or subcarbonate in 2-gram doses is to be given two to three times daily suspended in water. On the second day after the hemorrhage, raw eggs, which have been well beaten and cooled in a refrigerator, are to be taken slowly. The amount of milk is to be increased daily by 3 ounces, and one more egg is to be added, so that at the end of the first week $\frac{3}{5}$ liter of milk and six to eight eggs are to be

taken daily. In the period following not more than 1 liter milk is to be given per day in order to prevent an overdistention of the stomach. From the third to the eighth day after the last evidence of bleeding, finely chopped or ground raw beefsteak is to be given in amounts of 1 ounce per day, in divided portions, mixed with the egg, which is to be gradually increased until 2 ounces are taken daily. After two weeks the patient is to receive well-cooked rice and softened zwieback in addition to the continued albuminous food, and after three or four weeks a sufficiently mixed diet is to be given, although it is best to still measure accurately. The meat need no longer be given raw, but may be lightly broiled or well boiled, and of the vegetable group only those producing much gas and the fruits with skins need be avoided. Six to eight hours after the hemorrhage Blaud's pills, which have been finely powdered, are to be given. The following table will give in condensed form the above suggested diet list and the amounts of each food:

LENHARTZ ULCER DIET.

Nutriment.	Days after the hemorrhage.						
	1	2	3	4	5	6	7
Eggs	2	3	4	5	6	7	8
Sugar added to egg..	....	....	20	20	30	30	40 grams
Milk	200	300	400	500	600	700	800 c.c.
Raw chopped meat..	....	....	....	....	....	35	2X35 grams
Well-boiled rice ....	....	....	....	....	....	....	100 grams
Zwieback .....	....	....	....	....	....	....	....
Raw ham .....	....	....	....	....	....	....	....
Butter .....	....	....	....	....	....	....	....
Calories	280	420	637	777	955	1135	1588

Nutriment.	Days after the hemorrhage.						
	8	9	10	11	12	13	14
Eggs	8	8	8	8	8	8	8
Sugar added to egg..	40	50	50	50	50	50	50 grams
Milk	900	1L	1L	1L	1L	1L	1L
Raw chopped meat..	2X35	2X35	2X35	2X35	2X35	2X35	2X35 grams
Well-boiled rice	100	200	200	300	300	300	400 grams
Zwieback	20	40	40	60	60	80	100 grams
Raw ham .....	....	....	50	50	50	50	50 grams
Butter .....	....	....	20	40	40	40	40 grams
Calories	1721	2138	2478	2941	2941	3007	3073

It is very difficult to judge the actually favorable reports given of the efficacy of the Lenhartz method of treatment, since cases vary so greatly in their character. It is undoubtedly true, however, that a more generous diet after a hemorrhage adds very much to the rapidity of the healing of the ulcer, as the anemia, which is the greatest obstruction to rapid cicatrization, is more quickly overcome. Still, we must recognize that the ingestion of meat on the sixth day after a hemorrhage is a rather hazardous procedure, which few physicians will dare to risk. Others who have employed this method have come to the conclusion that with hemorrhage the simpler diet of milk, egg, and gelatine, which has been given, is much more desirable, while in ulcer without hemorrhage the Lenhartz diet can be safely followed and very often with brilliant results. Senator recommends gelatine most highly for the nourishment of the ulcer patient, which, in addition to possessing a high nutritive value, tends to check the hemorrhage. He recommends a liquid solution of pure gelatine, containing 15 to 20 grams of the substance suspended in 150 to 200 c.c. of water, to which some lemon juice has been added, and which is to be warmed before it is used. Every hour or two, and in urgent cases every fifteen to thirty minutes, 1 tablespoonful of this is to be given. In addition, fresh butter (without salt) and cream are to be given in small quantities, but often, so that even the most sensitive individuals will receive in the course of a day an ounce of butter and at least a half pint of cream. When the butter is not taken readily by the patient, it may be given in frozen balls without distaste, and in the same way the cream is often taken much more easily when frozen, either with or without sugar, in the form of ice cream. This diet, even undoubtedly after a hemorrhage, may be increased, so that the twenty-four hours' amount should contain 900-1,000 calories (gelatine with sugar, 200; butter, 235; and cream, 480-500 calories). When no further hematemesis follows, we can proceed rapidly with the increase in the amount of food, adding to this milk beaten eggs, etc. The decoction of gelatine, which becomes obnoxious to certain patients on continued use, as well as produces constipation, we give in less and less quantities until within a few days it may be dropped, unless blood is again found in the vomitus. There are various ways in which the gelatine may be employed, such as calves' foot jelly or chicken jelly, which can be made more palatable by the addition of sugar or fruit juice, or it can be added to ice-cream. The most convenient for use are the varieties known as Knox's Crystal gelatine and Plymouth Rock gelatine, which can be prepared merely by adding hot water. If patients object to

butter, we can use as a substitute emulsum amygdalæ, a very palatable nutritive, which is equal to cream in value and much richer in nitrogenous elements. Senator claims with this method of treatment to have obtained most brilliant results in the treatment of gastric ulcer. Summed up, we may say that with the Leube treatment we can always obtain the very best results with reference to the healing of the ulcer, whether associated with hemorrhage or not. Our patients, however, will not be in as good condition as if the Lenhartz diet were followed. If either treatment is properly carried out, our patients should not diminish to any extent in weight, and, if with the former method we cannot obtain this desirable result, we must immediately adopt the latter. For the recurrent attacks of ulcer, whether due to the opening up of an old ulcer partially healed or to a new one, since the surgeons tell us that they often occur in groups—perhaps not synchronous, but successive—we had best employ the more liberal diet of Lenhartz, especially with working people, to whom a long convalescence is not permitted on account of the necessity of quickly returning to their labors. As an adjuvant to the dietetic treatment, which is undoubtedly of the greatest importance, we may employ compresses, medicinal agents, and mineral waters. As stated, directly after the hemorrhage an ice bag should be placed upon the epigastrium, or a cold apparatus containing a coil of tubing may be placed there, through which water is allowed to flow constantly. If, after three months, pain is still present, it is well for those who can afford it to pass the night with an electric pad attached to the upper abdomen, which not only alleviates the pain, but probably improves the circulation. A small thermophore pad may be employed, filled with hot water and replenished during the night. This, however, must not be employed for several days after a hemorrhage, for it is not unusual, after the bleeding has ceased, on application of heat to the abdomen to see the hemorrhage recur.

Some authorities have employed gastric lavage, with various medicaments or with ice water, for the treatment of the ulcer. Fleiner recommends the introduction of bismuth in suspension by means of the stomach tube. To the rest of us, however, the use of the tube in an ulcer of the stomach seems a very hazardous operation and one to be strictly avoided. The increased blood pressure always associated with gagging on the introduction of the tube, which is strongly provocative of perforations of the ulcer, and fraying of the thrombus, which always checks the bleeding, would seem to be absolutely prohibitive of the introduction of the sound. From long experience it

has appeared to us that it is entirely useless to attempt to treat patients with gastric ulcer in an out-patient clinic, and, though they often strenuously object to giving up their occupation, we always urge strongly that they be treated as indoor patients. When for economic reasons it is impossible for the patient to rest in bed and receive a personally supervised diet, then it may be sometimes advisable to give medicinal treatment, though this has never proved very effectual. Bismuth has been a tower of strength in the treatment of ulcer, but has almost as many skeptics as defenders. According to Fleiner, 10-20 grams of bismuth subnitrate are to be suspended in a glass of water, and either introduced through a stomach tube (which would seem superfluous and is not without its dangers in case of ulcer) or given the patient to drink. After this half an hour should be passed lying on the right side, or, as Fleiner remarks, in such position that the bismuth comes in contact with the ulcer—not so easy a matter to determine when the position of the ulcer is not known. After this the breakfast may be taken. This is to be done daily for a few days, and then every other day until the symptoms (pain, "occult" blood, etc.) cease. It has been demonstrated on dogs that this bismuth forms a layer over the site of the ulcer, thus protecting it from the irritating influence of food, gastric juice, etc. The objections to this mode of treatment are that surgically it is poor policy to induce a crust over a wound, since it diminishes secretion and exaggerates the process of necrosis. Zweig reports a case where at autopsy, after death from gastric ulcer, the wound was filled with a hard, firm crust of bismuth, separable with difficulty from the surface of the former. It is probable that bismuth possesses largely anesthetic properties, but does not add in any way to the rapidity of the healing of the ulcer. Furthermore, an occasional report of poisoning by these large doses of the subnitrate, an effect largely overcome by the radiologists who employ the subcarbonate, is made. Silver nitrate has won more or less renown in the old days of empiricism, when we had not the analysis of gastric contents to guide us, but it has fallen into more or less disrepute. It produces, if persisted in, a pronounced argyria, and in my experience a physician, by taking it, became as swarthy as an East Indian. Afterward a surgeon removed his ulcer, but, of course, failed to remove his argyria. Then, too, it has been demonstrated that the silver increases gastric secretion, while at the same time it neutralizes it, and as it would seem, formed an endless chain, ever trying to neutralize the hydrochloric acid which it was inciting. Of course, from the start its use was purely empiric, based on a reaction of a school boy's test tube.

The dose when given is 0.008–0.03 ($\frac{1}{8}$ – $\frac{1}{2}$ grain), and each dose must be given dissolved in at least a tablespoonful (20 c.c.) of water. The olive oil treatment, on the contrary, is to be strongly recommended, for it diminishes secretion and forms a protecting surface over the site of the ulcer. It is to be taken in tablespoonful doses three times a day, gradually increasing a tablespoonful each day until a cupful is ingested daily. The only objections to its use on the part of the patient (consisting chiefly of eructations of oil) may sometimes be overcome by chilling it, or taking it in capsules or in the form of an emulsion. Sometimes, on account of the severe pain, it is necessary to prescribe a medicament, of which perhaps chloroform is the most valuable. This should be given in the following form:

R Chloroformi 1.0 or 15 minims
Bismuthi subcarbonatis 3.0 or 45 grains
Aquæ destillatæ, q.s. ad 180.0 or 6 ounces
M. Sig.: One to two tablespoonfuls hourly. Shake.

Anesthesin also, in doses of 0.2 gram (3 grains), taken directly after eating, has proved to be very valuable in controlling the pain associated with ulcer. It may be given alone or added to a bismuth powder, as follows:

R Anesthesini 4.0 or 1 dram
Bismuthi subcarbonatis 20.0 or 5 drams
M. Divide in chartulas XX.
Sig.: One powder half an hour before meals three times daily.

When the hypersecretion is very marked, it is sometimes necessary to neutralize this condition by means of the ordinary alkali powders, of which the following prescription is our favorite:

R Eumydrin 0.020 or $\frac{1}{8}$ grain
Sodii citratis.
Magnesii oxidi, $\ddot{\text{aa}}$ 20.0 or $\frac{2}{3}$ ounce
M. Divide in chartulas XX.
Sig.: One powder after eating three times daily.

Another form of treatment now much in vogue, especially when the ulcer is associated with hypersecretion and spasm of the pylorus, is to give twice daily a hypodermic injection of 0.0005–0.001 gram ($\frac{1}{120}$ – $\frac{1}{60}$ grain) of atropine sulphate, which has a marked sedative influence on these conditions, but in many people produces mild delirium or delirious fancies, and should not be used unless the patient is either in a hospital or under the direct observation of the nurse. For the

purpose of convenience, we may use the hypodermic tablets put up by the majority of manufacturing pharmacists, suitably divided into doses of $\frac{1}{150}$ to $\frac{1}{100}$ grain. This atropine is especially recommended where gastric ulcer is associated with vagotonus, whose relation to enteroptosis will be discussed more fully later. While many reports of hallucinations from the employment of atropine have been published, Zweig claims that he has never seen any ill results from the continuance of this treatment.

The employment of Carlsbad water in ulcer of the stomach has no purpose except where the acidity of the gastric contents reaches a high point, when the use of the water or a teaspoonful of the artificial Carlsbad dissolved in a cup of hot water, taken on rising and another before going to bed, will reduce the acidity, according to Jaworski, in the shortest time, though other observers are still skeptical in regard to this. This treatment, however, should follow the rest-diet period, for nothing could be more unwise than to give Carlsbad directly after a hemorrhage or in the acute stage of the illness. Furthermore, the constipation which often persists with ulcer is relieved, and to this, perhaps, is due the reduction of the secretion, since it has often appeared to us that confined bowels induce hypersecretion. Naturally, where the patient can afford it, a visit to Carlsbad and a systematic drinking of the water is of advantage, but this should never be advised until all acute symptoms of the disease have passed away. This treatment should be continued for three months after the acute attack, and unquestionably is a good prophylactic against a recurrence. Levico water has also served us well to overcome the anemia following ulcer. It is well to begin with a small dose (a tablespoonful) and gradually increase to the limits of toleration, watching results for the beginning of toxic arsenical symptoms, coryza, or nausea.

Now the question arises, when are we to regard the ulcer as healed? We have no criterion to settle this important question, but, if the spontaneous pain ceases and there is no tenderness on pressure, and, as Boas insists, chemical blood is absent from the stool, we may consider that scar tissue has formed over the ulcer. Even when the pain ceases, if careful examination of the feces still shows blood, the patient must continue all the precautions as to food and exercise as before. Hence the blood in the stool wins the greatest significance, for the ulcer may be healed and the adhesions produced cause pain and tenderness on pressure, but, as long as the slightest trace of blood is found in the stool on a meat-free diet, we are assured that the process of healing is not complete. When the ulcer assumes this indolent character and

there is evidence that the process is still active, it may be necessary to repeat the rest-diet cure several times before repeated examination of the stool assures us that complete cicatrization has taken place. These are the cases which haunt our clinics, obtaining a little temporary relief, but never complete restoration to health until a gastroenterostomy is performed. The latest statistics with reference to a cure by internal treatment show that 77 per cent are relieved by this means, 23 per cent are not aided, and 7-10 per cent die. Lenhartz and Leube both give a much greater percentage of cures by these means, but ulcer is notorious as recurring, and, when a physician discharges a patient as cured because symptoms have ceased, he often loses sight of him, and later another physician or hospital puts him through the same course of treatment with the same result. Again, if one can rely on the surgeon, multiple ulcers are common, judging from the scars found at operation, and what are regarded as recurrences of the same ulcer may be new ulcers dependent on the condition of the patient—whatever it may be which produces them—so that we should not treat the ulcer, but the dyscrasia, and that still remains the sphinx of pathology. Syphilis of the stomach, described by Einhorn and others, is a rare disease, seldom diagnosed, and not particularly amenable to treatment. It is usually hereditary, and consists of infiltrations, ulcers, or formation of scar tissue. Similar changes may also occur in the intestine, and the simultaneous discovery of syphilitic processes in the liver assures the diagnosis. Sometimes the cure of a long-continued gastric ulcer by anti-syphilitic treatment is reported, but it has also seemed to us from a very close sequence that ulcer has been produced by repeated salvarsan injections. Tubercular ulcer of the stomach is a very rare occurrence as compared with that of the intestine. Eisenhardt reports that in five hundred and sixty-seven instances of tubercular ulcer of the intestine he could find only one of the stomach, and only forty cases could be found in medical literature. The ulcerations are distinguished by much thickened borders and pale base, in which base tubercular and giant cells are numerous. Smaller caseous infiltrations have also been found in the submucosa of the stomach, containing tubercle bacilli. Simonds in two thousand autopsies of tubercular patients found secondary ulcer of the stomach only forty times. The operative treatment which is employed for excessive hemorrhage, perforation in the peritoneal cavity, with its chances for success, has been discussed fully in Chapter VIII and repetition is unnecessary. The treatment of stenosis and adhesions will fall naturally into the next chapter, and will not be anticipated here.

CHAPTER XI

ECTASIA VENTRICULI DILATATION OF THE STOMACH

Disturbances of motility form one of the most important features of gastric disorders, perhaps more so than those of secretion, because it is beginning to be a well-accepted axiom that the latter often depend on the former. Still there is much argument and discussion over the significance of impaired motility *per se* and true dilatation. We cannot begin to give in full the mass of material which has accumulated in regard to this question, but will consider only such points as are particularly associated with its therapy. When an attempt is made to give a definition of ectasis, we immediately come on the relative importance of anatomical changes and the functional ability of the stomach to empty itself in a prescribed time—as one physician expresses himself: "The radiogram of any portion of the tract, no matter how distorted or bizarre it may appear, means nothing to me until I learn what that portion, be it stomach or colon, can do"—so that, in order to make a diagnosis of dilated stomach, we must not only determine the size of its percussion outline, whether increased above the normal or not, but we must also by means mentioned learn how long it takes that organ to empty itself of an ordinary meal. This preparation is based on the fact that we can often demonstrate a much enlarged stomach whose functions are perfectly performed and whose possessor never has an untoward symptom relating to his digestion. This latter condition is sometimes called megalogastria, may be congenital or acquired (requent pregnancies), and is almost invariably associated with gasteritis. In this case we can readily see the protuberance of the abdomen formed by the enlarged and sunken stomach. Its existence in deep respiration, and still the patient makes no complaint of disturbed digestion. Such a stomach could not by any consideration of the imagination be regarded as pathologic, so that our definition of ectasis—dilated stomach—must be an enlarged stomach, with marked evidence of impaired motility, as evinced by tardy emptying. Furthermore, we must consider how great the impairment of motility must be to regard the case as in the category of dilated

stomachs. To do this, it is advisable to divide the condition into two classes: (1) first degree, where the emptying is delayed, but finally accomplished—a state sometimes called atony, or, better, hypotony; and (2) second degree, where the stomach is never fully emptied, but, even fasting, contains some food residue. This is true ectasia ventriculi. If these were progressive divisions of the same pathologic condition, then the former would imperceptibly advance into the latter grade, but such is not the fact, and they both remain as distinct entities. The hypotony is dependent on the weakness of the muscles of the stomach, may be congenital or acquired, and usually chronic, but may rarely be acute, as mentioned. This condition is ordinarily only a symptom of a state of general muscular weakness, called by Stiller "myasthenia universalis congenita." Just as we may have individuals whose arm muscles remain weak, undeveloped, and unable to raise a burden commensurate with the sex and age of the possessor, so we may have gastric muscles which are unable to contract firmly on the mass in the stomach and force it into the duodenum. In such cases there are other signs of the habitus enteropticus, and no therapeutic measure has any influence on the stomach which does not at the same time tend to build up the whole muscular structure of the individual, as well as improve his general condition. This is often best accomplished by increasing in every way the patient's nutrition, for he is as a rule markedly undernourished. Vastly different from this is the true dilated stomach, which depends on disease *per se* of the organ, consisting usually of a hindrance to the departure of the food from the stomach, and has nothing to do with the general condition of the patient. The stomach struggles harder and harder to force the food through the narrowed pylorus, often becoming hypertrophied in the process until, like decompensation of a hypertrophied heart, the muscles finally yield to superior force, and we begin to find gastric insufficiency, dilatation, and stasis. As long as hypertrophy of the gastric muscles persists, the stomach is able for a long period to force its contents through the orifice into the duodenum. In other words, referring to the illustration of the heart, compensation is nearly perfect, and only relative insufficiency exists, but, unless relief is given by making a new communication between the stomach and the intestine ("window in the stomach," as the newspapers have popularized it), this relative insufficiency is converted into an absolute incompetency, and more food is ejected by vomiting than reaches the intestine. But, apart from this, we may have disease of the muscular structure of the stomach itself—either atrophy, amyloid degeneration, or cancerous infiltration. In

this case there is no anticipatory hypertrophy, but the ejective power of the organ is impaired, insufficiency and enlargement take place, and the result is the same as in the former instance—stasis—which may be regarded of primary origin instead of secondary. Very rarely we may have a paralysis of the muscles of the stomach from central origin, as in acute dilatation following operation, or severe shock, and this condition is usually fatal. Occasionally we have a temporary acute dilatation of the stomach brought on by excessive eating, aided largely by alcohol, as is seen in the copious amounts of partially digested food brought up by one several hours after a debauch, particularly when the interval has been passed in a drunken stupor. In this chapter only the true gastric dilatation will be considered, as hypotony belongs rather to the functional forms of gastric disorders.

Causes.—The causes of this disease are, first, narrowing of the pylorus, and, second, disease of the musculature of the stomach. The stenosis of the pylorus may be congenital or acquired. The former usually leads rapidly to the death of the infant, if not operated, from constant vomiting and inanition. The acquired form may arise from pressure on the pylorus from outside, disease of the orifice itself, or pressure from the inside. The most common cause of external pressure is adhesions, producing twists, elongation, or compression, and arising from the adjacent organs (gallbladder, pancreas, mesentery, or intestine), or by tumors causing compression (large gallstones). Internally the pylorus may be narrowed by scar tissue from old ulcers, by pyloric spasm due to fissures, from the caustic effects of acids and alkalies (drinking lye), from thickening of the mucous membrane, by a gastritis largely confined to the pylorus, and by tumors (carcinoma, polypi, etc.). Another cause much more common than is generally supposed, as it seems to us, is severe gastrophtosis, which may not only cause obstruction of the pylorus by a kink, but may also cause narrowing of the choledochus with jaundice.

Symptoms.—The symptoms will vary according to the antecedent illness, and will differ markedly according to whether the dilatation is caused by malignant disease or arises from pyloric spasm. Hence we can describe only the symptoms produced by the ectasia itself. Subjectively, symptoms may be wanting just as long as the hypertrophied gastric muscles are able to drive the food through the narrowed pylorus, but will begin as soon as this power commences to flag. These consist of pressure and tension after every large meal, but there may be no actual pain, though an ignorant patient often describes the sensation as pain. Soon, however, the sense of tension persists after

smaller meals and often fails to relax in the interval between the meals, so that he describes it as continuous, relieved only by sleep. He notes also that the epigastrium is visibly protruded, in which case straps on a man and corsets on a woman cannot be endured. Soon come eructations, which first taste of the food swallowed, then sour or bitter, and finally with an odor of putrefaction (H_2S). One instance comes to our mind where the patient's involuntarily eructation in the office necessitated open windows for several minutes to dispel the nauseating odor. Soon the patient experiences the powerful peristaltic actions of the stomach, which may not at first be painful, but are often accompanied by a gush of the gastric contents into the mouth. These must not be confounded with the pulsations of the aorta, experienced by many patients who suffer from gastrophtosis. Thirst is a common symptom, which even large draughts of water fail to quench. As absorption is largely the function of the intestine and fluid cannot escape from the stomach, the skin becomes dry and wrinkled, while rapid desquamation of the superficial layer may take place. The most common symptom, however, is vomiting, which is unlike the ordinary vomiting of gastric catarrh that follows very shortly after food is taken. Here the vomiting is more periodic, occurring at intervals of a day or so, when large quantities of sour-smelling gastric contents are evacuated, often containing portions of food taken two to four days before. The vomiting occurs oftener and is more copious, and the patient becomes rapidly emaciated; headache and nausea are fairly constant and continuous, while numbness of the fingers and toes, obstinate constipation, and diminution of urine exist. Very rarely tetany may arise, a most fatal complication. Milder degrees of twitching of certain groups of muscles and even mild epileptoid attacks have also come to our attention, unquestionably dependent on the dilatation of the stomach, since relief of this condition caused the attacks to cease. Objectively, the marked emaciation and dryness of the skin, with the pinched look, attract attention, though these may be lacking in the early stage of the disease. Through the thinned and fat free abdominal walls during a peristaltic contraction one can see the contour of the stomach rise from the surface, by which both larger and lesser curvature can be easily made out. During the intervals of rest the borders of the stomach are discernible with a good light, but so are they in marked gastrophtosis in women with lax abdominal walls. Later on in the progress of the disease waves can be seen running from the patient's left to the right, which often culminate in a continued, almost tetanic, contraction of the stomach (rigidity). One should not, however, lose

sight of the fact that a pyloric stenosis and dilated stomach may exist without these signs of an exaggerated gastric peristalsis when the stage of decompensation has arrived. Two of our patients have been operated for a chronic ulcer and marked stenosis found when no gastric rigidity ever occurred under the most careful observation. When these stomachs are inflated with air or carbon dioxide, it can be readily seen that their dimensions far exceed those normally found. Palpation also will afford evidence of dilatation, for succussion exists far below the navel and seven to eight hours after food is taken. The best means, however, of diagnosis is the test meal of Riegel, or rather an adaptation of it, consisting of meat and potato, bread and butter, and boiled rice with raisins, or, better, rice pudding with raisins. If the patient is washed out seven hours after, and food fragments to any extent are found, gastric insufficiency is present, and with the physical signs of increased gastric area our diagnosis is assured. As there may be several degrees of insufficiency, if after the first removal in seven hours much debris is found, particularly if food from a previous day is found, a second removal after the same meal taken at evening should occur the next day. In fact, in our out-patient clinics this washout in the morning after the evening Riegel meal is the routine, and the seven hours between is usually chosen only for special cases; even in the latter case, where much insufficiency exists, copious food fragments will be found, and the gastric contents withdrawn after the subsequent test breakfast will be found to be much increased. The x-ray examination also aids very materially in that a twenty-four hour bismuth remnant speaks emphatically for pyloric narrowing.

The ectasia produced by intermittent spasmotic contraction of the pylorus can also be easily diagnosed. Such attacks often come on during the night, and a morning lavage following will either show food remnants, often with sarcinae, or a considerable amount of almost pure gastric juice. These cases are often the most satisfactory for treatment, because a mild diet and the use of antispasmodics will so ameliorate the condition that often a subsequent lavage after an interval of two weeks will show neither food fragments, gastric juice, nor sarcinae. Where such a favorable outcome does not follow, one can be well assured that an organic lesion is the cause, a chronic pyloroduodenal ulcer being the most common. When the dilatation is caused by obstruction from a pyloro-gastritis (linitis plastica), we always have a long antecedent history of gastritis, with loss of hydrochloric acid, and an abundance of mucus in the contents. In the course of the disease a marked dilatation of the stomach occurs, which taken with the

emaciation, loss of hydrochloric acid and presence of lactic acid leads one to think of cancer, but in my experience the patient never exhibits the peculiar cachectic color with this disease that he does with cancer and, of course, the duration of the former is much longer.

Treatment.—The treatment must be preceded by the most exacting study to establish whether we are dealing with a hypotony, associated with general muscular weakness, or a real stenosis. The former demands the most vigorous roborant regimen—cold baths, increased nutrition, massage, well-selected moderate exercise, and change of climate, the mountains proving most satisfactory; the latter requires that the stomach be spared as much as is consistent with the establishment of normal nutrition to overcome the marked emaciation. An equally grave error is committed whether we adopt forced feeding in ectasia or a dry diet in hypotony. Unfortunately, both these errors are committed by physicians, largely because sufficient care is not taken in establishing a correct diagnosis. Every "slopping" stomach does not spell dilatation, nor is a morning residue to be interpreted as exaggerated myasthenia gastrica.

The treatment of true ectasia is made up of (1) dietetic, (2) physical, and (3) medicinal agencies:

1. The *diet* must be based on the degree of insufficiency and the character of the secretion. The food should always be in such a form as demands the least effort on the part of the weakened gastric musculature to drive it through the narrowed or normal pylorus. Our advice often is that food must be so fully divided that it will pass through a colander. The amount taken at one time must be minimal, and, in order to maintain a nutritive equilibrium, the meals must be taken at short intervals. The quality of the food must depend largely on the character of the secretion. If hydrochloric acid is abundant, we may make free use of protein in the form of meat, fish, fowl, eggs, cheese, and milk; meat may be given in finely divided form, for the proteolytic activity of the digestive fluid is unimpaired. Carbohydrates are less desirable, because the increased natural acid inhibits amylolysis. Vegetables must be given in purée form and in small portions, and bread is best employed as toast and zwieback. Sugar is to be taken sparingly, since it incites a marked transudation (diluting fluid) into the stomach's interior. Fats are usually badly borne, and resulting fatty acids arising from the stasis act as an irritant. Unsalted butter and cream, as well as good olive oil, can be employed in moderation. All condiments, alcohol, and excessive use of tobacco must be avoided. When, from the overstimulation of the peptic

glands by the long delay of the food in the stomach, they fail in their secretion, the character of the diet must change; protein must be reduced and limited to the most digestible—white meat of chicken, oysters, soft cream cheese, dropped eggs, and minced fish. Here is where the predigested protein foods—laibose, somatose, etc.—as adjuvants come into their own. The feature to be especially emphasized in the diet is that the food shall be in a semisolid form. The employment of a dry diet, as was formerly the custom in both hypotony and ectasia, has no purpose whatever, but it has been shown experimentally that first the fluid, then the semisolid, and last the solid articles of food, after being liquefied by the transudation, sometimes called the diluting fluid, enter the duodenum through the orifice. Hence it can be seen that the stomach provides fluid for liquefying solid articles of food from its own circulatory vessels, and Kemp has shown that after the dry test breakfast the amount of gastric contents withdrawn is often greater than when fluid is given, since it probably furnishes a greater incentive to the secreting powers of the stomach. Thus solid food alone may cause a greater volume from which the organ is to free itself than when liquid or semisolid articles are taken. Our greatest precaution, then, must be that liquid food shall contain the largest possible nutritive value, which can be accomplished by using milk as a basis and adding the various flours, rice, predigested foods, etc. The amount of fluid taken must not exceed 1,000–1,500 c.c. (2 to 3 pints), and, whenever possible, should be made nutritious by the addition of egg albumin, sugar, malted milk, oatmeal, etc., to the water, or the use of the milkshake. All effervescent drinks are to be avoided, but iced coffee, tea, etc., well fortified with cream, may be used, or, if the thirst is excessive, the mouth may be rinsed out with ice water, which is not to be swallowed. When, however, the motor power of the stomach reaches its lowest ebb and the organism suffers from its lack of fluid (dry and wrinkled skin), rectal injections of salt water ($\frac{1}{2}$ teaspoonful to a pint) may be employed several times daily, and it is sometimes surprising to note the rapidity with which such injections are absorbed. Patients will feel discomfort from the retention of a cupful at first, but will soon be taking a pint at a time without any difficulty. Instead of the salt a teaspoonful of beef extract may be stirred into the water before injection. The best indication for the use of these enemata is the diminution of the urine; when this falls to a pint daily, enemata must be begun immediately. When, in spite of diet and daily lavage, the vomiting persists and the weight sinks, it is advisable to put the patient to bed and give nourishment wholly by

rectum for ten days, when very often the sufferer can begin to take food again per os without discomfort, a result, unfortunately, which is not permanent. These views are summarized in the following diet list:

DIET LIST IN DILATATION OF THE STOMACH WITH ABSENCE OF HYDRO-CHLORIC ACID.

On rising.—Gastric lavage.

Breakfast.—A large cup or bowl of hot milk, with a tablespoonful of tea or coffee in it, and two slices of toast well buttered.

Midforenoon.—A bowl of oatmeal gruel made with milk, with a tablespoonful of gliadine or laibose cooked in it, or, if preferred, it may be eaten as porridge with milk and sugar.

Dinner.—Potato or pea soup (cooked until creamy, no lumps), with a beaten egg cooked in it; three tablespoonfuls of lean minced chicken, beef, or fish (no mackerel, halibut, or salmon), best put through a meat cutter before cooking; two slices of toast buttered, as before, and three tablespoonfuls of mashed potato or squash.

Midafternoon.—A large cup of milk, with a teaspoonful of cocoa, and two zwiebacks (zwieback to be moistened in the milk before eaten).

Supper.—A bowl of oatmeal, tapioca, or cornmeal gruel and two slices of toast well buttered, as before. If patients awaken during the night, they may be given a cup of custard or some gelatine with milk and sugar, flavored with some fruit (Knox's or Crystal Rock).

As stated, when there is an excess of hydrochloric acid, we adopt a diet containing much more protein, whose general characteristics are given in this dietary:

DIET LIST IN DILATATION OF THE STOMACH WITH EXCESSIVE HYDRO-CHLORIC ACID.

On rising.—Gastric lavage.

Breakfast.—Two dropped eggs on toast, cup of cocoa made with milk, to which a tablespoonful of cream is to be added.

11 a. m.—An eggnog, with a teaspoonful of laibose added.

Dinner.—Chopped or minced chicken, fish, or tenderloin, cooked with butter; three tablespoonfuls of mashed potato, squash, or white turnip, or well-boiled rice; a light pudding (Indian meal, bread, or gelatine), with cream and sugar; a glass of milk, with a tablespoonful of laibose or somatose.

4 p. m.—A bowl of custard, with two slices of zwieback well buttered.

Supper.—Tenderloin steak or a chop well minced with knife and

fork; two slices of toast, with a ball of butter and cream cheese spread over them; a cup of cocoa made as before.

Bedtime.—A glass of milk, with a tablespoonful of laibose.

2. *Physical treatment* consists almost wholly of lavage, and here again a marked distinction must be made between the hypotony, which is harmed instead of benefited by this treatment, and true dilatation due to stenosis. Where washing out the stomach removes the stagnating mass made up of the previous day's food, patients (those who perform it themselves as regularly as they brush their teeth or make their toilet mornings) assure us that it is an absolute prerequisite for the enjoyment of their breakfast. Furthermore, this procedure gives the stomach a short period of rest from its burden, and checks the hypersecretion which is brought about by the irritation of the constant presence of food. When this act should be performed depends largely on the severity of the case. If the retention is only moderate and motility delayed, but not to the point where much residue is found in the stomach mornings, the evening is the best time, for then the organ gains a long period of rest. When, on the contrary, a large food residue is found mornings after the Riegel meal of the evening before, then morning is the time, for we must give every opportunity for the food to pass into the duodenum in order to overcome the progressive emaciation. In the former case the last meal must be taken not later than 6 P. M. and the lavage take place not earlier than 10 P. M.

The advantage of systematic lavage is soon seen. The vomiting ceases, there is less pain, eructations diminish, the urine increases in amount, and the patient soon begins to take on weight. Furthermore, we have evidence of improvement in the fact that the mass of food fragments washed out mornings grows less and less until we obtain only a large amount of gastric juice, which lends to the wash water a marked hydrochloric acid reaction when Toepfer's reagent is added. In other words, the ectasia ceases, but the hypersecretion persists. How long this lavage should be continued is difficult to say. Patients have come under our observation who have continued it for years, feeling perfectly well in the meantime, until, wearied of its annoyance, they have elected an operation. Others after a short period are temporarily relieved of its employment until some indiscretion in diet or an excessive meal, as at a banquet, has demanded its renewal and the stasis has appeared intermittently. When the dilatation is dependent on malignant disease, but little can, of course, be expected of the daily washing; in fact, the patient seems to become worse from the ex-

haustion produced by it. The most brilliant results are found where the stenosis is due to the formation of scar tissue following an ulcer or pyloric spasm caused by an erosion or fissure.

As far as our experience is concerned, but little is gained by the addition of medicinal agents to the water used for washing, except where marked hypersecretion or putrefaction exists; in the former case sodium carbonate or artificial Carlsbad salts (a half teaspoonful to a quart) can be employed, and in the latter ichthyol (10 drops to a quart) proves most effective. Not much can be expected of any of the antiseptics because the fluid remains such a short time in the organ. To be effective, however, the patient *must be taught* to wash out his or her own stomach, because, to be of any avail, it must be done daily, and an individual with other cares will not go regularly to a physician or a clinic. Massage, electricity, and the spray will accomplish nothing, for the hypertrophied stomach in its earlier stages possesses powerful peristaltic action, which cannot be increased, and, when this stage is passed, the obstruction has become so great that it is hopeless to attempt to overcome it by increasing the motor power of the stomach. This, of course, does not apply to myasthenia without obstruction, where these means often offer the most available and effective agencies for hastening the emptying process.

3. The *medicinal treatment*, too, gives us but little encouragement. When the obstruction is largely due to spasm associated with hypersecretion (whether chronic ulcer, as is generally supposed, exists or not), olive oil or the emulsion of sweet almond oil often checks the cramp and diminishes the hypersecretion. A very good homemade substitute for the pharmaceutical preparation can be made by grinding a tablespoonful of sweet almonds, pouring a cup of hot water over them, and mashing them thoroughly with a pestle; this is then passed through a coarse sieve and drunk, lukewarm and sweetened, a half hour before the meal is taken. There is always a powerful suggestive influence in preparing personally a medicine, as, for example, Bishop Berkeley's tar water, which each patient could prepare for himself from inexpensive ingredients, and, as the good divine expresses it, "it was a sovereign remedy." Cohnheim, who introduced the olive oil treatment, would have the patient take a half cupful after the morning washing or introduce it into the stomach through the tube already in situ; later the patient should take a wineglassful an hour before each meal. For the disagreeable eructations, resorcinol had been our favorite until a clinic patient, suffering from both gastrectasia and rheumatism, after the disappearance of the latter, for which aspirin was

given, clamored for aspirin for his eructations, which he declared ceased entirely while he was taking that drug. Since then its use in many other cases of unpleasant eructations has justified its employment for this purpose. We give it in 0.3-gram (5-grain) capsules or tablets after the meal. For the constant heartburn due to hypersecretion an alkaline powder is necessary, and great ingenuity must be often employed to find one which is effective, for, strange to say, the patient's suffering is not always measured by the degree of acidity. Our favorite is as follows:

R Magnesii oxidi 30.0 or 1 ounce
Sodii citratis,
Calcii carbonatis præcipitati, aa 15.0 or $\frac{1}{2}$ ounce
M. Sig.: One-half to a teaspoonful dry on the tongue, followed by
a wineglass of water, a half hour before eating.

Constipation, if present, as it usually is, must not be treated by laxatives, but by glycerine suppositories or enemata, for, as stated, the laxatives are sure to increase the hypersecretion and pyloric spasm. Very often the stomach washing, by hastening and increasing the amount of fluid which enters the duodenum, will also alleviate the constipation. In spite of all our efforts, many cases are found which do not improve, and an increase in the amount of fasting residue, a diminution in the amount of urine, or a marked loss of weight, though an ample diet is taken, emphasizes the necessity of a gastroenterostomy. Whether at the same time a pylorectomy should be done (suspicion of malignancy) must be left to the surgeon at the time of operation, as he has means of information with the lesion before him which the internist has not. It has probably occurred to all of us to have patients return a year or more after the simple gastroenterostomy with recurrence of symptoms, which a subsequent laparotomy proved to be due to too small an orifice at the original operation, or that the loop of the jejunum leading from the stomach has become partially obstructed by adhesions, but these instances are so extremely rare that, in our estimation, they form no objection to the operation.

CHAPTER XII

CANCER OF THE STOMACH

We are so accustomed to consider cancer of the stomach as an object of accurate diagnosis only when it has reached appreciable size, which always means an advanced stage, that we look with incredulity on its early detection. Still, at some time in its development the growth cannot be greater than a rice grain, and it is not against belief that eventually we may be able to detect it at this early stage. Without doubt, certain changes take place in the secretion with the very earliest advent of the cancer cells, and our whole efforts must be directed to the detection of this beginning dyscrasia, a goal which, alas, in our present state of knowledge is unattainable. Leaving out of consideration, then, these ideal conditions, we must take into account only those earliest factors which will allow us to make a probable diagnosis of gastric cancer, and those are beginning ulceration and minute hemorrhages detected in the gastric contents and feces, as well as the beginning of changes in the motor function of the attacked organ.

Regarding the duration of cancer of the stomach, at two years, based on numerous observations, it is very probable that hemorrhage begins very early in its career, and in all forms of digestive disturbances after 40 years of age the repeated examination of the feces for blood should never be neglected. Furthermore, since the majority of the growths begin at the pylorus, or near it, in the prepyloric portion of the minor curvature, a site which, by producing masses of the growth in the lumen, swelling of the mucous membrane, and spasm, leads to impaired motility and stasis, finding food remnants in the fasting stomach is probably the second earliest sign of gastric cancer, and should be sought also in all digestive disturbances of those beyond the age mentioned. The beginning ptosis of the stomach, produced by the growth, also exaggerates the stasis, so that the earliest subjective symptoms of the patient arise from retention of food, plus its decomposition, induced by a vigorous growth of bacteria. The changes in secretion have hitherto held the stage to too great a degree in diagnosis of this disease, and have proved a broken reed. These symptoms, then, arising from stasis will be considered in turn, beginning as far as pos-

sible with the earliest and taking them up in order as they develop during the course of the disease.

Pressure and Distention After Eating.—Pressure and distention after eating, occurring in one who has hitherto had no digestive difficulties, are often the earliest warning signal, and should not be passed over lightly. These are particularly suggestive when at the same time the stomach is found prominent, filling the epigastric area, hard to the touch, and relief is obtained by eructations of gaseous or liquid material or vomiting. The hindrance to the emptying of the stomach, together with the distention due to bacteria, causes these peculiar symptoms. It happens quite often that the objective stasis (by washing the stomach or radiogram) precedes the sensation of pressure by considerable time. Usually the sense of fullness is distributed over the entire epigastrium, or it may be more marked on the right in the region of the pylorus, under the xiphoid, or in the back. Rarely a stabbing sensation is experienced under both costal arches. Generally, the feeling is intermittent, beginning within the first two hours after food is taken and lasts an hour, though it may be more or less continuous. The amount and quantity of the food (brown bread, greens, radishes, watercress, etc.) exercise a marked influence on increasing the severity of the pressure symptoms, which differentiates cancer from nervous dyspepsia, where a small easily digested meal causes as much discomfort as a larger. The greatest distress is caused usually by meat, and particularly boiled cornbeef on account of its coarse fibers. Individual peculiarities play some rôle, for pork, ordinarily considered difficult of digestion, may sometimes be borne by these sufferers from gastric cancer better than beef, while some declare that sweets are their undoing, and others complain of vegetables. True, there are other affections—especially the gastric neuroses of women near the climacteric, reflex gastric disturbance from cholecystitis, esophageal obstruction near the cardia, benign ulcerations of the stomach, and hypertrophic cirrhosis of the liver—which produce pressure after eating, but, coming in those who boast their possession of an excellent digestion all their life, it has an ominous significance. Practically all of these conditions, except gastric neurosis and ulcer, can be readily eliminated. When an individual of ripe years, previously healthy, comes to the physician with a tale of indigestion, accompanied by distress after eating, increased by a large meal of coarse food which does not yield to simple means, but is steadily progressive, and tries to assure the physician that it was brought on by a single indiscretion in diet, it should not be regarded or treated as gastric catarrh, but looked on with sus-

picion, and no conclusion should be reached until every means known has been employed to exclude gastric cancer.

Eructions and Regurgitations.—Eructions and regurgitations are also manifestations of gastric stasis, though they may arise from gastric neurosis. From occasional "belching" to persistent vomiting there is a progressive gradation. They may occur spontaneously, or may be aroused by bending or by exercise, which compresses the stomach. The peculiarities of the aërophagy of neurasthenics have been mentioned, but the gaseous eruptions of the cancer patient differ from the former in usually being noiseless, possessing an odor, and frequently occurring at night. *Acid eruptions* of cancer belong to the earliest period, long before the appetite or general condition of the patient has begun to suffer. They are the result of fermentations, which, in turn, are dependent on an insufficiency of the stomach and diminished hydrochloric acid, and the acid fluid is usually made up of the organic acids—butyric, acetic, and lactic. Never should it be taken for granted without examination that they are due to an excess of hydrochloric acid. This symptom is usually associated with the emptying of the stomach, and comes on two to three hours after the meal, but may come at night. The ingestion of brown bread or rye bread is especially liable to bring it on. Instead of this acid eructation the patient may have brought up a mouthful of a brackish-tasting fluid (water brash), which must not be confounded with excessive secretion of saliva, also a rare accompaniment of cancer. Vomiting is the last stage of regurgitation, and comes late in the disease, or may not occur at all. Where the growth is diffuse and the stomach much contracted, this symptom is liable to come early and occur after the smallest amount of fluid is taken. When the growth is confined to the pylorus and marked ectasia follows, vomiting is less frequent, but very copious when it occurs. The act takes place most often two hours after the hearty meal of the day, or may occur at night. When it begins in a healthy individual and is persistent, it should not be attributed to something which "disagreed" with the patient; the indigestion was often only incidental to the cancer which preceded it. When well established, vomiting can be as readily aroused by a drink of cold water as by solid food; in fact, some victims can take solids better than liquids. Another peculiarity often mentioned by patients with this disease is that all three symptoms—eruption, regurgitation, and vomiting—occur more particularly when they are lying on their right side. These are cases where the growth is at the pylorus and the narrowing is apparently exaggerated in this position; at least,

when nausea is aroused by lying on the right side, it signifies a lesion at the pylorus and usually of the organic kind. In general the vomitus contains food, less rarely bile, though this is possible where the growth is at the fundus, and, while blood may be vomited late in the disease, it does not occur in large quantities. The "coffee grounds" vomiting is especially significant when found beset with numerous lactic acid bacilli, though it may be found in severe icterus, gastric crises, acute peritonitis, sepsis, and pneumonia. Fecal and fetid vomitus signifies a perigastric abscess from the growth which has opened into the stomach, or a fistula into the colon or ileus from the pressure of the tumor.

Pain.—Pain is a fairly common accompaniment of gastric cancer, but it is sometimes surprising to see the disease run its course without any marked complaint of pain on the part of the patient. This symptom also is due to the struggle of the stomach to empty itself of its contents, and usually during the attack one can see, synchronous with the look of distress on the patient's face, the rigid stomach forcing itself above the level of the abdomen. After eructation the pain often ceases, and the stomach at the same time relaxes and becomes soft. Such a complex condition invariably means a growth at the pylorus, and is associated with the stage where no marked dilatation of the stomach has taken place, nutrition is but slightly impaired, and hydrochloric acid persists, which may be the instigator of peristalsis or pyloric spasm. These intermittent attacks of pain are the most suggestive symptoms about early gastric cancer, and, if more attention were paid to them, there would not be so many false diagnoses of gastric catarrh made, for the latter disease uncomplicated is not accompanied by pain. Curiously enough, pain becomes a less and less important feature as the disease progresses, being thus in marked contrast to the rapid growth of the tumor. This is probably due to the adaptation of the stomach to the internal pressure by dilatation, diminution of its peristalsis, and obliteration of hydrochloric acid-producing glands. The pain is rather bizarre in its position and direction of radiation, usually of colicky character, but, still, well-defined types can be recognized. There may be the right-sided variety, which, beginning at the right costal arch, streams to the corresponding portion of the back and to the right shoulder blade, markedly resembling, as can be seen, gallstone colic. There may be girdle pain, beginning under the xiphoid and extending to both sides along the costal arches, to meet in the back. Pain may begin in the epigastrium and extend to the left nipple and left shoulder blade. Again, the pain may be felt

almost exclusively in the lumbar region, and can be distinguished from the pain of retroperitoneal metastasis of the glands or cancer of the pancreas only by the fact that the former is aroused by taking food, while the latter two are liable to be constant. While ordinarily these pains begin two to three hours after food, if deferred to six or seven hours, it should not mislead one into regarding the duodenum as the site of the growth.

Appetite.—The appetite is usually affected early, and patients exhibit a great distaste for food, especially for meat. Still, this is not invariably so, and the maintenance of an excellent appetite should never be utilized as a diagnostic point against the presence of cancer, for the medullary variety without stenosis, or a rapid ulceration of a scirrhouus tumor at the pylorus, is not inconsistent with an excellent appetite. Thirst is usually increased, which has some diagnostic value in cancer as against neurosis, for in the latter case patients often state they never care to drink except possibly at mealtime. This desire for fluids is as prevalent in those who do not vomit as in those who do, so that the progressive anemia may be regarded as a cause, since this peculiarity is often noted in pernicious anemia. As the means of physical examination and the findings have been discussed fully in Chapter IV (page 89), it will be only necessary here to briefly call attention to the fact that in comparatively few cases can the tumor be felt, at least at a period when, if anything is to be done, we must act. Hence we must rely on other physical findings, such as the "ballooning" of the stomach, which is often so marked that its outline may be seen, or at least the lower border readily felt by the palpating fingers. During this process eructations of gas occur, and the organ may be felt to collapse under the fingers. Visible peristalsis is another excellent guide, whose interpretation is pyloric stenosis, but it can be utilized with other factors as meaning cancer. Epigastric pulsations are to be considered of great value in diagnosis of malignant growth resting on the aorta, provided that the stomach can be demonstrated to be under the visible pulsations and not below them, as in gastrop-tosis. When this pulsation is associated with a murmur heard with the stethoscope over the epigastrium, systolic in time, exaggerated by pressure of the bell, and heard loudly in deep expiration, it gains enormously in diagnostic value. Often the thickened pylorus can be felt during contraction, and under the palpating fingers fluid can be felt to spurt or gurgle through it. This, however, can be utilized in favor of cancer only when stasis has been demonstrated and there is blood in the feces. The tumor, when palpable, may assume many shapes. The

small billiard ball variety may lie to the right of the median line, just above the navel, but be felt best when the patient lies on the left side; its attachment to the stomach is often indicated by the fact that, when pressed, regurgitation by the patient often takes place and the spouting can be felt easily under the growth.

Associated Symptoms.—Associated symptoms, having reference to other organs, are often found and can be utilized in the early diagnosis of gastric cancer. Among these is the marked atrophic changes in the tongue, which demonstrate themselves in the form of a smooth, slimy, paper-like surface, either confined to the middle or extending generally over its entire area. These, apart from pernicious anemia, where they are sometimes found, are pretty closely confined to the former disease. A coated tongue is a rare concomitant of cancer, which is probably explained by the atrophy mentioned above. Decayed teeth are commonly found, and the poorly masticated food and exuberant growth of bacteria associated, which are necessarily swallowed, may play a part in the causation of gastric cancer. Constipation is usually found, or this may alternate with diarrhea. Cases which are suspected of gastric cancer, in which the latter symptom is persistent, usually turn out to be pernicious anemia. Occasionally a rather profuse hemorrhage from the growth may cause diarrhea, its disintegration with copious production of pus, or the establishment of a fistula between the stomach and the colon after the growth encroaches on the latter. Constipation is the rule, however, and also a very early sign, and, when a very elderly person suffering from indigestion becomes suddenly markedly constipated, gastric cancer should be thought of and excluded by the most careful examination. "Constipated old age," the slogan of a popular nostrum, often has a sinister meaning, and is not so lightly overcome as the proprietors would have us believe. It is curious to note that this form of constipation, associated with malignant disease of the stomach, is immediately overcome by a gastroenterostomy, so that it is purely of gastric origin. Intestinal rigidity in sympathy with the gastric variety is a rare occurrence, but a mass of metastatic glands in Douglas' pouch may produce so much obstruction that a true stenosis exists, and the violent, visible peristalsis may lead us to think that this is the primary site of the growth. This form usually goes also with fluid in the abdomen from invasion of the peritoneum, and may require tapping before the masses can be felt, as in a case recently under our observation. This condition will not be so often taken for a rectal cancer if we examine the mucous membrane of the lower segment of the intestine, which we

shall find intact, the pressure coming from the outside. The discovery of supraclavicular metastases in the glands on the left side would clear up this question in an instant. The invasion of the peritoneum may be purely local or general, even in young persons. R. Schmidt reports its presence in a girl of 18 years, originating from a medullary cancer of the greater curvature, established by autopsy; hence we should not be satisfied too early with the diagnosis of tubercular peritonitis. Subphrenic abscess on the left side is often a complication by which tenderness under the left costal border and obliteration of the sulci between the ribs by the pressure of the abscess is not uncommon. The left pleura may also become involved, and the abscess sometimes break into the corresponding pleural cavity. When, at the last stage of the cancer, perforation into the peritoneal cavity takes place, chills, collapse, and general abdominal tenderness announces that fact, as in a case of ours already described under the consideration of cancer engrafted on ulcer (page 310). Perhaps the most common complication of gastric cancer is the invasion of the liver, and this usually takes place without jaundice. If suspicions of a gastric growth is aroused and jaundice is a marked feature, it is more likely to be confined to the pancreas, or, more rarely, the duodenum. Although this process of metastasis in the liver may be painless, yet there are other cases where the invasion is excessively painful, and, when there is temperature, may lead one to think he has to do with a cholecystitis or hepatic abscess. When the tumor masses are largely confined to the left lobe and cause a marked depression and advancement of the liver's edge, these metastases may be mistaken for the gastric tumor itself. The early presence of hydremic conditions of the blood and lowering of the circulatory tonus must be made responsible for the presence of moderate edema, which is less marked over the shins than over the internal malleoli, and particularly the saerum; hence these points should never be neglected when the tibiae fail to respond. In women metastases in the ovaries are not uncommon, and have led to useless operations. The color of the skin is either pale-gray, resembling closely that seen in tuberculosis, or has a yellowish tinge, when it reminds one of pernicious anemia. In the latter case both bilirubin and urobilin are absent from the urine, so that the color cannot be of hepatic origin.

Physical and chemical findings in cancer of the stomach have been fully discussed under the respective chapters, but perhaps a résumé will not be out of place. An individual over 40, with a pasty or lightly-yellow tinged color, who has been losing flesh, has a prominent epigastrium, with marked resistance under the right costal border near the

median line, due to spasm of the rectus, whether a mass can be found or not, with an enlarged flaccid stomach or a small firm one, whose lower border can be distinctly felt, with occasional intermittent increases and diminutions of rigidity, and a slight edema over the internal malleoli, may be said to be strongly suspicious of gastric cancer. If, in addition to this, he shows moderate stasis, sarcinæ with diminished hydrochloric acid, or lactic acid and its bacilli (long, threadlike), with no hydrochloric acid, "occult" blood in the stool and possibly the "thread" bacilli, or sarcinæ also, such an individual should be subjected to an exploratory operation, perhaps after being x-rayed, without any hesitancy.

In our opinion, when we have watched for a well-defined tumor, profuse hemorrhage, or absolute loss of hydrochloric acid, we have waited too long, and operation is practically useless except for relief of the pain and stasis. On account of the great importance of detecting this disease early, perhaps a word or two more in regard to diagnosis will not come amiss. Stasis may be due to obstruction at the pylorus, caused by either ulcer or cancer, and many of the symptoms mentioned, including "occult" blood, may come from either. Then our aspiration is to reach a diagnosis before a tumor appears, a factor which promptly separates the two diseases. Hence reliance must be placed largely on the persistence of the normal or increased hydrochloric acid and digestive leucocytosis, as well as the absence of the peculiar color of malignant disease. A sufferer from chronic ulcer with stenosis may show excessive pallor, but never the yellowish tinge so characteristic of malignant disease, no edema, no metastases, though it must be acknowledged that the latter are not found in the early stage of cancer, nor a tryptophan reaction. Then, chronic gastritis possesses certain similarities with cancer in the absence of hydrochloric acid, but never signs of stenosis, sarcinæ, lactic acid bacilli, or pain. Physicians have been too prone to call these early symptoms of indigestion in elderly people gastric catarrh, resting comfortably on that opinion until increasing stasis warns them that malignant disease lies at the bottom of the difficulty; in fact, gastric catarrh, though commonly found at autopsy, when patients never suffered digestive difficulties during life, is rarely alone the cause of much discomfort, and complaints made by the patient usually arise from the antecedent disease (cirrhosis of the liver, regurgitant heart disease, etc.). To us pernicious anemia has often proved the most difficult to disentangle from gastric cancer because frequently accompanied by the ominous color, loss of hydrochloric acid, and edema. Apart from the distinction by

means of blood examination between a primary and secondary anemia, we have other differences which aid us, and R. Schmidt has arranged them in the following table:

ANEMIC TYPE OF GASTRIC CANCER.	PERNICIOUS ANEMIA
Constipation	Long continued diarrhea
Enlarged spleen, rare	Common
Pain on pressure over lower half of sternum, rare	Common
"Occult" blood in stool.....	No blood in stool
Lactic acid bacilli in stool, common.....	Only rarely

Cancer of the gallbladder is also difficult to differentiate from primary gastric cancer because, by pressure on the pylorus or duodenum or extension, we have anorexia, ectasia, increased gastric peristalsis, "coffee ground" vomiting, achlorhydria, and sarcinæ. This is particularly true when jaundice is not a marked feature, and sometimes happens when the disease is confined strictly to the gallbladder. When, however, jaundice is the main feature, but all these symptoms and findings relative to the stomach are present, as in a case recently seen in the clinic, accompanied by invasion of the liver, gallbladder cancer is primary. Cancer of the cardial end of the esophagus often proves a stumblingblock because the obstruction may not be sufficient to be detected readily by the tube or sound, and no evidence of stasis or increased peristalsis is present; difficulty in swallowing may not be marked, and one has only the increasing loss of weight and cachexia. In such a case, however, under my observation hydrochloric acid was lacking. The importance of a correct diagnosis is seen at a glance, for no one would for an instant recommend an operation if assured that the growth was at that point, unless for the purpose of staying death by starvation, since there is no pain naturally from increased peristalsis.

Treatment.—The treatment other than surgical is the most hopeless and unsatisfactory task that falls to a physician. We can only hope to relieve pain by treatment, which, as it is largely due to the struggle of the stomach to empty itself, must be dietetic in the sense that only the most finely divided food is allowed to enter it, nor must this be wholly liquid, for, when the secondary dilatation has taken place, over-distention is a thing to be avoided. Then, again, when the state of achlorhydria is reached, we must restrict the protein to the smallest possible limit, for the whole burden of its digestion is thrown on the pancreas. The earlier stages, when stasis does not exist and the diagnosis is assured, if the patient refuse operation, or an x-ray exam-

ination indicate that the growth is diffuse and not removable, we must employ the diet list given on page 302 for chronic gastritis with absence of hydrochloric acid. When retention begins to be marked, we may employ the dietary suggested under ectasia, with modifications adapted to the failing peptic power. This diet can be found under ectasia with absence of hydrochloric acid (page 331). Small and numerous meals are desirable, and condiments should be used freely to stimulate a desire to eat and whip the flagging energy of the peptic glands into activity. Fat must be restricted to butter and cream, especially when the motility begins to be impaired. Meat should be limited to the white meat of chicken and lean fish (cod, haddock, etc.) on account of the excessive distaste of patients for meat. Vegetables in purée form and mush made from various grains, taken with milk and sugar, must be the mainstay of our diet. Milk, eggs, and custards will prove grateful to the patient and are nutritious, but the first must be fortified by various concentrated foods and made palatable by tea, cocoa, coffee, brandy, and whisky. On account of the rapid loss of weight, only moderate exercise should be allowed, and much of the patient's time should be passed on a couch, since we wish to restrict metabolism to the most limited degree. As to medicinal treatment, no drug has ever been discovered which has the slightest effect in staying the progress of the disease. In the early years of our practice (twenty-six years ago) we heard much of the merits of condurango as a cure for gastric cancer, but, at the most, it can only temporarily improve the appetite. It may be given either as an infusion, like digitalis, in a strength of 15 grams to 180 c.c., of which the dose is a tablespoonful, or, better, since more convenient, in the following guise:

R Fluidextracti condurango 30.0 or 1 ounce
Sig.: Twenty drops in water before meals three times daily.

Or

R Infusi condurango 15.0: 180 or $1\frac{1}{2}$: 6 ounces
Acidi hydrochlorici diluti 6.0 or $1\frac{1}{2}$ drams
Syrupi sacchari, q.s. ad 200.0 or 7 ounces
M. Sig.: Tablespoonful before meals three times daily.

The various stomachics may be tried to increase the appetite and give encouragement to the patient, of which the orexin tannate in $\frac{1}{2}$ gram doses may be given twice daily an hour before meals, followed by a glass of water. As mentioned, the more convenient way is to use the orexoids of Merck, tablets of 0.25 gram (4 grains), of which 2, well pulverized, are to be taken twice daily under the same conditions.

Among the complications which cause great distress to the patient, but which are rarely sufficiently profuse to endanger life, are the attacks of hemorrhage from the stomach. In general, the same treatment should be followed as in ulcer—rectal feeding and the hypodermic injection of the contents of 1 ampule of aseptic ergot. To control the nausea, one can give chloroform (3 to 5 drops) on a small piece of ice, or 10 drops of a 1 per cent solution of cocaine hydrochloride in the same way, or resorcinol combined with laudanum, which also controls the pain, as in the following:

R Resorcinolis	2.0 or $\frac{1}{2}$ dram
Tincturæ opii deodorati.....	5.0 or $1\frac{1}{4}$ drams
Syrupi aurantii	30.0 or 1 ounce
Aquaæ destillatæ, q.s. ad.....	180.0 or 6 ounces

M. Sig.: Teaspoonful every four hours.

Later we have to combat in most cases the pain, and one must begin slowly to use narcotics, for the demand steadily increases until often enormous doses are required to keep the patient comfortable. At first employ codeine, of which the Newer Formulary provides an elegant preparation, syrupus codeinæ, that in only teaspoonful doses will produce much effect. This, as personal observation has shown, will keep the patient comfortable for a long time. Anesthesin in 0.2-gram (3-grain) doses in the bonbons put up by the manufacturers is also a mild alleviative of pain and ranks with codeine. Comparing favorably with these in efficiency is the following:

R Orthoformi.	
Aspirini, $\ddot{a}\ddot{a}$	10.0 or $\frac{1}{8}$ ounce
M. Fæc in capsulas XX.	

Sig.: One capsule half an hour before meals three times daily.

Eventually, however, we must have recourse to morphine, and for a time suppositories of morphine sulphate, 0.015 ($\frac{1}{4}$ grain), and atropine sulphate, 0.0005 ($\frac{1}{120}$ grain), will suffice, but, unless necrosis of the growth frees the passage, the dose of morphine by suppository will have to be doubled, and soon the hypodermic syringe will be the only weapon which will stay the suffering. This is fully justified, but follow the old-school motto, "festinamus lente," and do not be in too much of a hurry to employ the more vigorous means. The only physical treatment of any avail is the gastric lavage, and then only in the early stages. It makes no difference whether the stagnation is due to narrowed pylorus or to diffuse medullary growth of the fundus, which also causes a marked gastric insufficiency. Lavage in the early stages

removes the decomposing contents, relieves the nausea, checks the vomiting, and, it seems to me—though the statement is based wholly on empiric knowledge—defers the fatal termination. In the later stages the patient is so weak and the amount of food taken so small that it does not seem worth while to torment him with the tube. Most patients readily learn to wash out their own stomachs, and fly to it for relief from their discomfort, and here just a word of caution: while direct transference of cancer cells has never been proven, still, when a tube of ours has entered a stomach which contains a malignant growth, the patient becomes the possessor of the tube. Of course, tubes are always thoroughly sterilized after employment, but in cancer there is always a repugnance against ever using that tube on another. A lavage is not always necessary, for the mere introduction of the tube and removal of the accumulated contents in the stomach often affords great relief. Our earliest recollection of Boas' clinic was to see the patients enter, be given a tube, and then often fill a pail half full of accumulated stagnant residue, with every evidence of great relief. Some patients, however, can easily excite the center of vomiting by passing the finger down the throat and in this way empty their stomachs. Massage should never be employed in the vain hope of increasing motility of the stomach in this disease, for hemorrhage may be easily incited in this way. Mineral waters should never be employed under the vain hope of removing mucus or "cleaning" out the stomach from its stagnating residue. If employed, the patient is invariably worse.

CHAPTER XIII

ENTEROPTOSIS (SPLANCHNOPTOSIS)

This term indicates that all the abdominal organs have left their customary site and assumed a new one, usually below the former, but they may also undergo simultaneous lateral change of position. Two groups of cases can be readily distinguished as possessing this condition:

1. The women who from frequent childbearing, removal of abdominal tumors—in fact, from any laparotomy—lose the tone and elasticity of the abdominal walls, which aid in the support of the organs and allow them to fall.
2. The second group comprises both men and women, even children, who are born with narrow chests, too small to allow lungs, heart, stomach, colon flexures, and kidneys in the thorax within the limits of the costal arches, so that the organs below the low-lying diaphragm are forced downward. In these individuals there is also a peculiar lack of muscular tone, which persists long after muscular development should have reached its acme, but changed intraabdominal pressure has nothing to do with the condition as in the former. The distinction between the two classes is brought out more fully by their clinical history and groups of symptoms than by the anatomical and pathological differences. Of course, there must be insensible gradations from one form to the other, for the woman with hereditary enteroptosis will necessarily have this exaggerated by childbearing and the organs will descend still lower, but in no case does the hereditary form reach the excessive degree of displacement that the acquired will. In marked cases of the latter, one is reminded of the kangaroo, for all the woman's abdominal organs are apparently carried in a pouch, extending sometimes halfway to the knees, and, still, such an individual will often not suffer half as much as the possessor of a moderate degree of congenital ptosis. Many theories have been advanced for the lowering of the abdominal organs, one of which is that the lungs themselves exert a pull on them, thereby lessening the amount of weight to be sustained by the abdominal walls and the pelvis; hence the more powerful the chest is developed, the stronger the pull of the lungs by their con-

traction on the diaphragm and the organs immediately below it. In all cases of enteroptosis Mathes claims he found a flat, weak, and depressed thorax, which narrowed the pleural cavity and diminished the lungs' elasticity. The subsequent course is the flattening of the diaphragm, the liver begins to drop, and the other organs must lead the way. All this is aided by the muscular weakness of the individual, who cannot oppose vigorously developed abdominal walls to the descent of the organs upon it and the extra burden of support. Such theorizing would be but little better than that of medieval times, when ecclesiastics discussed how many devils could dance upon the point of a needle, were it not so essential to discover the mechanical difficulty so as to oppose a mechanical aid. Strauss regards the congenital enteroptosis, so-called, as a persistence of the infantile type of body, and many cases in our experience have impressed themselves upon us as instances of arrested development rather than of general muscular weakness. One case, a young lady of 17 years, with marked ptosis of stomach and colon, existing since birth, had the appearance of a boy of 12. She had menstruated only once, the breasts were undeveloped, but, with the narrow chest, sloping ribs, and acute epigastric angle, the girl's muscles were well developed, and she could play a vigorous game of tennis. Regurgitation of food and persistent constipation, associated with periods of depression, made life a burden for her, and a cure was effected only by a gastrocolic suspension.

In connection with the acquired form of enteroptosis, much has been said pro and con in regard to its causation by corsets. The outcome is that a well-fitting article has no effect on the muscular well-built woman, but a most decidedly deleterious effect on the weakling, pushing the already mildly prolapsed organs still further down. This is true not only of corsets, but also of the bands and belts by which the lower garments of women are suspended above the hips, which are equally as mischievous. Patients will say that these are not tight, but, if so, why do not the skirts drop off over the hips, as they would do if no belt were used? It was the contribution of O. Kraus, who studied the subject with the x-ray, to show us what actually happened when the corsets were put on. The lower portion of the thorax is narrowed (particularly anteroposteriorly), the arch of the lumbar region is exaggerated, and the diaphragm is forced downward more on the right than on the left; the abdomen is elongated upward, the thorax shortened, the lower borders of the lungs stand higher and their volume is diminished, the heart is raised, the cardia is forced higher, and the lower border of the stomach is depressed. A muscularly developed

body will reassume its natural position on account of its elasticity as soon as the corset is laid aside, but a fragile one soon assumes this artificial shape, much as do the feet of the Chinese women after months of compression. Nothing is ever accomplished permanently by exaggeration, and the wild statement that corsets cause this condition is, of course, ungrounded, for we would have no explanation for this condition in men, nor in women who have never worn corsets. By those congenitally affected and by those who have acquired it by childbearing, corsets and bands around the waist should never be worn. It is not always wise to jump at the conclusion when an acquired enteroptosis is discovered that this accounts for all the symptoms, for in the clinics hundreds of this form will pass through your hands without a symptom, except possibly constipation. Kyphosis, also, is often associated with enteroptosis, the stomach frequently being found as low down as the pubes without symptoms pertaining to this condition, though in one case, reported at the time, ulcer was found and relieved by operation. Another cause for this condition was the rabid anti-obesity cures, now fortunately given up, by which fifteen to seventeen pounds were removed in a fortnight, as in the case of a lawyer of our acquaintance, who spent a year recovering from the effects of it.

Symptoms.—The symptoms must be divided into two classes—those which pertain to the digestive organs themselves and those various nervous manifestations which probably are a part of the general complex of which the ptosed organs form another; in other words, myasthenia universalis. The general appearance of the patient often discloses his ailment. An apathetic look; a pale, transparent skin; a narrow chest, with ribs running directly and sharply downward; broad intercostal spaces, and often the floating unattached tenth rib; the narrow epigastric angle, and the utter absence of adipose tissue under the skin, all form the stigmata of this condition. The "floating tenth," of which so much has been made by Stiller, is not a constant concomitant of this condition (congenital form), and, furthermore, attachment to the sternum may vary all the way from firm to a ligamentous union, so slight that it is difficult to differentiate it from freedom. Then, sometimes one finds the free tenth rib without enteroptosis. It would seem to us that its lack of attachment was more dependent on the peculiar position of the ribs, which run downward at such a sharp angle; this leaves the terminus of the tenth rib at such a distance from the sternum that attachment is difficult. As the position of the ribs causes the narrow chest and the latter the descent of the stomach, one can easily see the relation, but no necessarily rigid correlation of the

three factors. One noticeable symptom about all sufferers from ptosis is their tendency to malnutrition, which manifests itself as a moderate degree of emaciation. Even small children with this abnormality are very nervous, as the parents say, or irritable, as we would call it, and, in spite of every effort in the way of increasing nourishment, fail to keep pace with the development corresponding to their age. These children also suffer from lack of appetite, which is interpreted as a "weak stomach," are easily tired, and at puberty or afterward a well-marked ptosis is found. Apparently the food is not promptly forwarded by the descended stomach and vague discomfort is experienced by the individual, which restrains him from eating sufficiently, as that is supposed by him to increase his distress. Following this there develops a moderate degree of anemia and inability to apply oneself diligently to any undertaking, a mental as well as a physical weakness following. There is still some question as to the relation between enteroptosis and gastric neurosis. Some would attribute all the dyspeptic and nervous symptoms to the anatomical change in the position of the stomach, but others have advanced excellent proof of their lack of association in the following points:

1. Those who suffer from this condition, as they pass adult life, lose their nervous irritability and experience no further difficulty with their digestion, though the stomach and colon remain in their distorted condition.
2. As stated, we may find the most extreme grade of acquired enteroptosis without a digestive symptom, and occasionally, in the congenital form with well-marked displacement, no complaint is made of indigestion.
3. At autopsy some of the most bizarre anomalies of position of intestine and stomach are found where no complaint was ever made during life, and in pregnancy it is well known that all the digestive organs must assume new positions.
4. We often find hypersecretion associated with gastrophtosis, whose subjective symptoms can be overcome by treatment, but the position of the stomach remains the same and the hydrochloric acid is not lessened. Neither the excess of hydrochloric acid nor the position of the stomach caused the symptoms, but the excessive nervous irritability of the patient. We can only theorize in explanation by saying that persons with an unstable or undeveloped nervous system, which causes the gastric neurosis, also have an unstable and undeveloped muscular system, which causes the enteroptosis. Still, there are actual pathological conditions which are closely associated with this change of

position of the digestive tract. Take, for instance, the kinking of the ureter from nephroptosis (prolapse of the kidney), often producing hydronephrosis; the acute angle of the splenic flexure of the colon, whereby in the radiogram a portion of the transverse and the descending part seem to be adherent, producing symptoms of stenosis; the twisting of the horizontal portion of the duodenum, producing symptoms of narrowed pylorus, accompanied by vomiting; and the frequent association of jaundice and gallstones, with the pull produced on the choledochus by the prolapse of the duodenum or liver.

Inspection of the abdomen shows a peculiar configuration. The distance between the xiphoid and the navel is apparently lengthened, the waist line is sunken, the epigastrium is concave or canoe-shape, and there is bulging at the navel. This is the condition in the congenital form; in the acquired, when the patient stands, the pendulous belly is easily discerned. The diastasis or separation of the recti, with visible peristalsis, belongs only to the latter form where women have borne children rapidly. Pulsations of the aorta are also plainly visible, and in a young person it is rare that this does not presage a gastroptosis. When the fingers are placed over this pulsating part, pain is often experienced, and it is sometimes difficult to differentiate it from the tender point of gastric ulcer until it is found that the stomach is below the palpating fingers. When one compares the feeble heart sounds and radial pulse with this powerful action of the abdominal aorta, it would seem that some local influence produced it. This has been ascribed to the irritability of the celiac plexus, incited by the pull of the prolapsed stomach upon it, which, at the same time causes the pain. To particularize, we must consider each organ in turn which is liable to be displaced, for they are not all necessarily ptosed at the same time, and, even if they are, some will produce symptoms and some will not. For instance, with combined gastroptosis and coloptosis we may have eructations and heartburn without constipation, or vice versa.

GASTROPTOSIS.

Gastroptosis alone, or in combination with other ptoses, is probably not more common, but more easily distinguishable, since the outline of the stomach is easily made out, while that of the colon is much more difficult, and for its position we must rely largely on the x-ray examination. Of a ptosis of the whole organ, one can hardly speak, for the cardia is fixed and only the pylorus and antrum are freely movable, so that it is this portion which changes its position by moving

downward and to the left until the whole organ often assumes a vertical direction.

By radiogram it has also been shown that the course of the food is changed in gastrophtosis and that it does not enter the fundus, but



Fig. 19. Radiogram of stomach in congenital gastrophtosis. Organ lying wholly below diaphragm with patient standing. (Collection of Dr. Arnal W. George.)

falls directly to the antrum, thus pushing the pylorus still further downward and increasing the distance between the cardia and pylorus. This stretching takes place at the expense of the muscular structure, so that the organ cannot be contracted on its contents and soon be-

comes atonic. The diagnosis is made more probable by the presence of marked succussion either at a point where it is not usually found, below the navel, or at a time when not customary—two hours after a test breakfast or five hours after a hearty meal. This does not always indicate atony, but that the stomach has slipped from its position beneath the costal arches and is lying against the abdominal wall. Distention with the effervescent mixture also shows the lower border below the navel, and the upper border is distinctly seen, a thing that never happens in a normal stomach. Sometimes without the distention of gas, if the patient is asked to press downward, the lesser curvature comes into view; the percussion outline of the inflated stomach will show the upper border at or below the costal arch. Unfortunately the inflated stomach often assumes bizarre shapes, which do not always correspond to its real anatomical relation, so that we fly to x-ray examinations, which, in spite of scoffers, rarely lie. When the tonicity of the stomach is maintained, in spite of its changed position, the bismuth, and presumably the food, does not take longer to depart than in the normal stomach; in fact, some declare that a hypermotility exists. Gastroptosis is always associated with a group of perverted sensations, either connected with nervous dyspepsia, such as gaseous eructations of the noisy kind, veritable fire-cracker explosions (which at a clinic patients are only too anxious to exhibit to the doctor), cardialgia or painful lump in the throat, and nausea unaccompanied by vomiting, or with the results of the mechanical change of the position of the stomach. Patients complain of the dragging sensation in their abdomen after a full meal, and often content themselves, among the poorer classes, with a little soup or rice to avoid this. Discomfort of this nature can also be allayed by lying down. Others have a persistent backache while on their feet, induced, as is supposed, by the pull of the filled stomach on the celiac ganglion, which is also found tender, while patients also complain of the throbbing of the abdominal aorta that can be seen pulsating. It is rather surprising to note the number of women in an out-patient clinic, the mothers of eight to fourteen children, as they tell you, who complain of these symptoms. It is also difficult to always exclude gastric ulcer, but those with ptosis feel worse while standing than when lying on the right side, worse after a large meal than after a small one, though it be liquid, while the tender point is above the stomach, all of which is the reverse in gastric ulcer. Sufferers from gastroptosis, over 50 years of age are always apprehensive of cancer and a reassurance of freedom from it aids greatly in dissipating symptoms.

COLOPTOSIS.

Coloptosis plays a much less important part than the ptosis of the stomach, but, still, has its evils on account of the persistent constipa-



Fig. 74. Radiogram of W-shaped colon.

tion that accompanies it. There may be a prolapse of either the hepatic or splenic flexure, usually the former, or, what is more com-

mon, of the transverse, by which the V-shape or W-shape is assumed, causing stasis. Curshman has called attention to the vagaries in the position of the sigmoid, changes due either to congenital malformations in the mesentery or local peritonitic processes, which must always be differentiated from simple asthenic sinking of the colon. The diagnosis of coloptosis can usually be made by inflation of the colon through the rectum, either by air or water, when percussion will give its outline, though, of course, with some artificial changes not justified by the actual anatomical position; or, what is much better, by radiogram or an examination with the fluoroscope, by which also the question of adhesions can usually be settled.

Symptoms.—The symptoms of coloptosis are not usually severe, unless, as sometimes happens, a local peritonitic inflammation takes place accompanied by adhesions, when symptoms of real stenosis may be found, demanding in one case, in which our interest was aroused, an anastomosis of the cecum with the sigmoid. That a simple ptosis may cause a stenosis is out of the question; the feces move more slowly through the distorted canal, but move they do. Another unpleasant result of the prolapsed colon is the spasmodic contraction of certain sections, which can be felt as a round cord or sausage-like body, the "corde colique" of Glenard. Whether they ever relax is difficult to say, for at subsequent examinations of the patient they are found at the same place. The favorite site is the sigmoid, less common the descending and transverse colon, and almost never the ascending and cecum. This spasmodic contraction, contrary to general belief, has nothing to do with constipation, the fecal matter passing through this part of the tract readily. Mucus in the stool is, in our opinion, a frequent concomitant of this condition, but whether a causative relation exists between them is not certain. It does produce, however, the most dolorous sensations in the patients, mostly neurotic men and women, described as a constant pain, never leaving except in sleep, a feeling of heat on one side (where the cord could be felt) and cold on the other, a feeling as if all motion of the gas in the intestine stopped at this point (transverse colon just beyond the hepatic flexure). The latter two were x-rayed, a marked V-shaped loop being found in one and an apparent adhesion between the ascending and transverse colon in the other, with complete relief in the one by operation (separation of adhesions) and absolutely no change in the sensation of the other (suspension of the colon).

The cecum mobile also belongs to coloptosis. In the right iliac region we find a tympanitic area where succussion may be easily

elicited, with some tenderness and frequent complaint on the part of the patient of occasional evanescent attacks of pain, which often arouses suspicion of chronic appendicitis. Lordennais gives a pathognomonic sign of this condition, which consists of elicitation of pain when the fecal contents are forced from the transverse and ascending colon into the cecum by massage, but none when the contents of the cecum are pushed into the ascending colon; pressure directly over the cecum relieves the pain, but it returns when the hand is removed. Constipation usually accompanies this atony of the cecum, and the radiogram usually shows that this portion of the colon is very much prolapsed; in fact, in one case under our observation almost reaching the rectum. Operation showed no pathologic changes of the appendix, but there were adhesions which held the cecum in its distorted position, evidently starting from that appendage. On account of the stagnation of fecal contents in the cecum, a chronic colitis is started up at this point, with tenderness and a dragging sensation. Many physicians reject operation as useless, and rely on diet, massage, etc., but in a few cases under our observation, some of which had been treated medicinally for long periods (the one mentioned above for five years), freeing the adhesions has given relief from pain and checked the constipation. When constipation is a prominent symptom of coloptosis, it is apparently not due to the mechanical distortion of the intestine, but to nervous influences, for, when the colon has been properly suspended, the restricted defecation still continues. As a further proof of the lack of causative influence on the constipation by the abnormal position of the colon, we may observe that diarrhea exists as often as the opposite condition. Zweig regards both states as not connected with the malposition, but associated neuroses—one a state of depression and the other one of excitation.

NEPHROPTOSIS.

Nephroptosis, or prolapse of the kidney, was formerly regarded of great import before our knowledge of nephroptosis was enlarged to include all the abdominal organs liable to ptosis. While the kidney alone may be prolapsed, as a general rule it is merely a symptom of universal ptosis, whether congenital or acquired. The cause is, primarily, weakness of the muscular structure of the abdominal walls, and, secondarily, the presence of prolapse of the right colic flexure, pressure of the liver, unduly long renal vessels and ligaments, gasterctasis, rapid childbearing, and the use of ill-fitting corsets. Hence

it is largely restricted to women, though men are sometimes sufferers from it. Formerly there was a glut of kidney suspension and fixation, but, as very little relief was ever obtained, because the kidney was only one of the various organs which had undergone ptosis, at present but little is heard of this operation. Its frequency is much more common than suspected when a search is made. In an out-patient clinic, under our supervision, much frequented by women who have borne many children, the records showed that at least in one of every ten cases a note was made of prolapsed right kidney, with the lower pole at the navel and sometimes even below; so common is it, in fact, that no attention is paid to it, except when the patient complains of frequent micturition with an absolutely clear urine. A left-sided nephroptosis is much more uncommon, although Albu in 3400 patients in his polyclinic found it in 4 per cent of the males and 11 per cent of the females. It cannot be as frequent in the United States, or else we are not as skillful in detecting it. The detection of the prolapsed right kidney by bimanual manipulation is not difficult. The patient lies on the left side, while the examiner, placing his left hand against the lumbar region behind, makes opposing pressure with the finger tips of the right hand under the right costal border, and asks the patient to breathe deeply, by which means four degrees of dislocation can be determined:

1. The kidney shows itself movable by respiration—a normal condition according to J. Israel.
2. The kidney shows a dislocation of the first grade—that is, one-third to two-thirds of it can be felt.
3. The kidney shows a dislocation of the second grade—that is, allows itself to be moved freely by the palpating fingers and moves with every excursion of the diaphragm.
4. The kidney is displaced and fixed by adhesions—in other words, has assumed a new position and is firmly fixed there. Only dislocations of the first and second grades are congenital, and, when the kidney is firmly fixed by peritoneal inflammation, the displacement is caused by some mechanical means.

Symptoms.—The symptoms of nephroptosis are rarely characteristic, and are more often due to the nervous irritability accompanying it. The women, who are the chief sufferers, complain of fullness and a dragging sensation in the upper right half of their abdomen and often of a pain in the sacral or lumber region. All these symptoms are less burdensome or disappear when the patient lies down, and are much exaggerated when she is on her feet all the day. Very rarely

does a kink in the ureter occur sufficient to cause a hydronephrosis, and then only when associated with an abnormal blood vessel. In a clinic where hundreds of these women pass through monthly it is rare to find more than a complaint of an irritable bladder, with frequent micturition, dependent on this prolapse. The urine is, in our experience, invariably clear and contains no albumin, though Winternitz declares intermittent albuminuria not uncommon. The outcome of all forms of these ptoses appears to indicate that, once a possessor of a prolapsed kidney or stomach, always a possessor, unless by a fortunate surgical operation the ptosed organ can be stitched in its proper position and made to remain there, which, on account of the relaxed condition of all tissues, is difficult. That the time often comes when patients complain no longer of symptoms is true, but the kidney has not ascended to its proper site—at best, has become fixed in its new position, so that it no longer “wanders”—nor has the stomach made its way back to its home under the costal arches. At the most, the patient has put on fat, so that the malpositions can no longer be detected by palpation, or, what is better, the patient has lost his nervous irritability without replacement of his organs. This is not uncommon after 50 years of age, and a “cure” of this kind in a minister who had suffered all his life from nervous dyspepsia, and carried his stomach largely in the left lower quadrant of his abdomen, brought us no little local renown. Anyone who imagines that, by the suspension of a kidney or stomach, his patient is immediately cured will meet with many disappointments, and will soon learn that he advises a suspension in the same way that he writes a prescription—with no positive assurance that either will produce a cure. After the suspension, however, hygiene and roborant measures are vastly more effective than before, but must be continued for a long period before the normal tone is restored. The length of life is not shortened one iota by the presence of enteroptosis, nor can anything in our experience, be found to assure one that the victims of this condition are any more liable to pulmonary tuberculosis, pernicious anemia, etc., than any others, though they often succumb to it as do others. Furthermore, they are surely much more free, if not entirely so, from degenerative diseases of the heart and blood vessels, such as cardiac dropsy, apoplexy, arteriosclerosis, and angina pectoris. Stiller would have us believe, also, that the possessor of prolapsed abdominal organs is much less liable to rheumatism, diabetes, and chronic renal diseases. Osler may well say, “Blessed be he who after 60 has albumen in his urine,” evidently meaning that, when conscious of it, the patient takes better care

of himself, but it is difficult to persuade patients that with enteroptosis they are to be envied of their neighbors because less prone to these other ailments.

TREATMENT.

The treatment of enteroptosis is regarded by all as still a faulty one, since no means has yet been devised to raise with certainty the prolapsed organs to their former position outside of direct suspension by a surgical operation, and even then, unfortunately, in many cases they do not remain permanently where placed. But associated with these displacements, as stated, there is always an unbalanced nervous system, and here prophylaxis plays a prominent part in avoiding and delaying as far as possible what the family physician can readily see lies in store for those children with these anomalies. The school physician should also be warned that those whom he can readily recognize as of the Stiller type should be spared as far as possible, particularly at puberty, the undue mental strain brought on by prizes and other incitements to greater mental effort, by which often a long period of nervous dyspepsia and its discomforts may be avoided. One hears so often of students "breaking down" under their studies, but it is usually those with their stomach in the wrong position. These youths should be carefully instructed as to diet by urging them to indulge in milk, cheese, eggs, fruits, and vegetables, rather than meats, for many of them are truly carnivorous animals in their habits. The asthenic chlorotic girl, with stomach below the belt line, does not need, so much, rare beef and Blaud's pills as she does cheese, butter, and tennis. Athletics should be indulged in to moderation, for it is impossible by their means to make a brawny man out of a narrow-chested stripling of a school boy, and often the latter, in his efforts to equal his neighbor in acts of prowess, does himself actual harm. All these precautions are taken, not to correct a malposition, but to stave off its concomitant, gastric neurosis, which, if deferred by hygienic means beyond the age of puberty, may never make its malign appearance. The real therapy of enteroptosis aims to accomplish two purposes—first, by mechanical means to prevent the further descent of the displaced abdominal organs, and, second, by various forms of treatment to check the multitudinous symptoms of gastric neurosis which accompany this condition. The first purpose is accomplished partially by the various abdominal bands, originally recommended by Glenard, and, as human ingenuity has a wide field here, the number of recommended supports is legion. But right here we must bear in mind that

it is usually only the acquired form that can be benefited by a binder, because in this case there is more or less protrusion of the abdomen, the German "Hängebauch," while the victim of the congenital form often has a flattened or even concave abdomen, with absolutely no part at which the counter pressure of a band can be applied. For the former class we recommend bands of linen, cotton, or silk, with or without whalebone supports, and, if one can judge from the expression of relief by those who have dragged about with a steadily increasing pull

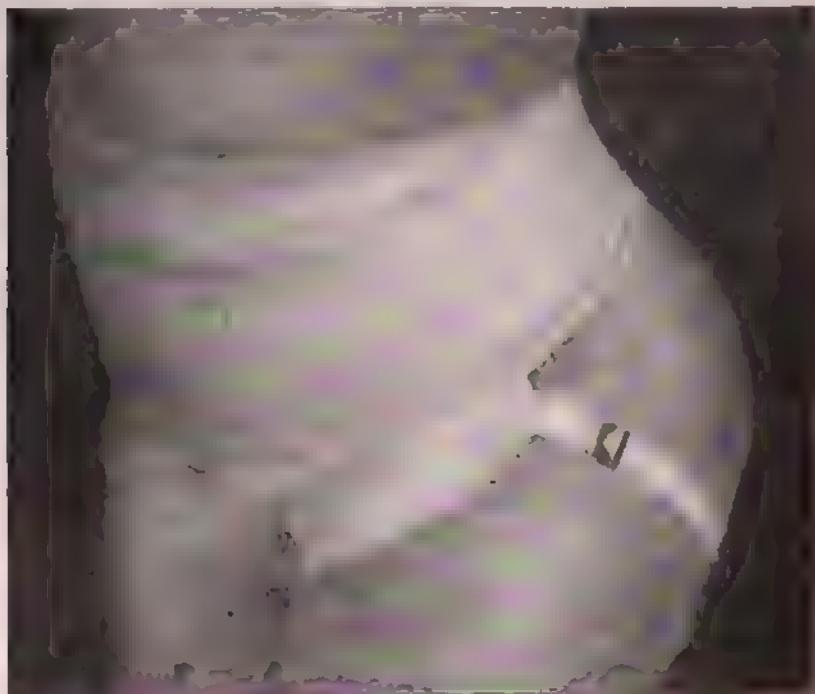


Fig. 71.—Storm binder for gasterptosis.

from their ptosed organs, the use is justifiable, even if we do only replace the lost resiliency of the weakened abdominal walls and do not raise the displaced organs an atom. Our custom is to determine the lower border of the stomach by percussion and order a pad placed below this line, stitched to a band, which furnishes added comfort, or, if the right kidney is down, the pad can be placed just below the lower border of this organ when the patient is lying and in full inspiration, although all must be somewhat skeptical about holding up a kidney. This, of course, requires that every band be made to measure, for, of

all abominations, the readymade abdominal belt is the worst. To prevent the belts from rising, straps of cotton or small rubber tubes must pass between the thighs, and in fat women particular care must be taken that talcum powder be used freely, for the chafing in hot weather may set up a sharp vulvitis in women. Often they prove so annoying that they are given up by patients, and many have attempted to hold the belts down by fastening them to the stockings. These do not need to be worn at night, and some insist that when put on before

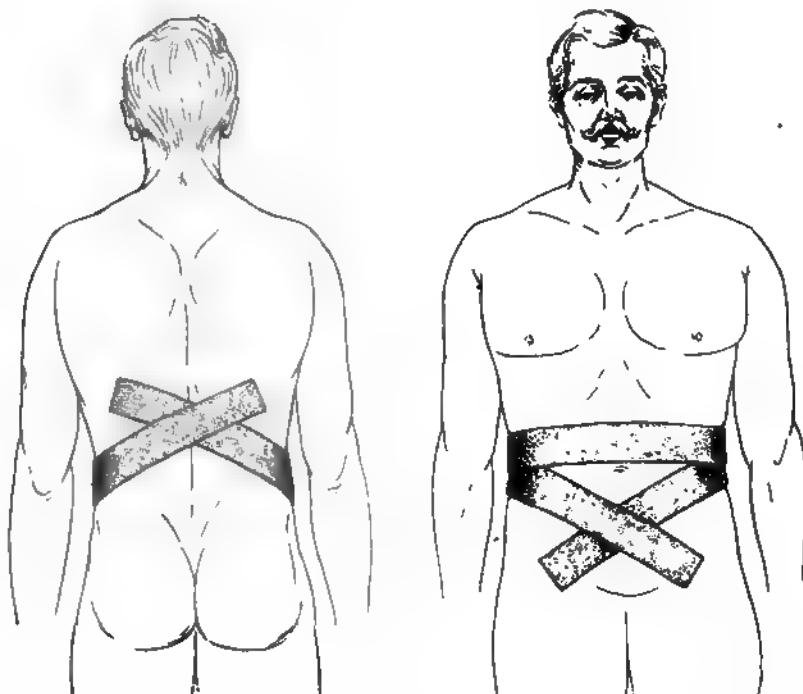


Fig. 72.—Application of plaster according to the Rose method, rear view.

Fig. 73.—Application of plaster according to the Rose method, front view.

rising, they should hold the abdomen with the same contour it had before assuming an erect position, a test few of them will stand.

Not all patients find relief in the belts, so that in the clinic it is always customary to apply the plaster bandage of Rose for a couple of weeks to learn whether support of the abdomen will relieve the discomfort, which, if successful, is followed by the recommendation of a band. The end of a good 2-inch adhesive zinc plaster is attached to the skin of the back next to the vertebral column and brought diag-

onally around the left side of the chest and abdomen, drawing or pushing up on the latter to the right Poupart's ligament, just inside of which it is cut off; now, beginning at the same point in the back, bring another strip around the right side, so that its end shall lie just within the left Poupart's ligament; then apply the third piece horizontally, with its center below the lower border of the stomach in the median line, and extend the two ends upward and backward, drawing up as much as possible on the pendulous abdomen until the ends meet in the back. No portion of the plaster should touch the crest of the ileum.

This plaster support can be worn for a fortnight, when, if it does not come off readily, it can be easily removed with the aid of a little ether. It is rare that any irritation of the skin occurs, but, as a pre-

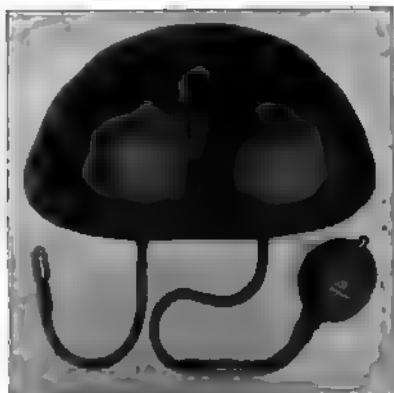


Fig. 74 Enriquez air cushion, with bulb for inflation.

ventive, the patient is advised to rub in talcum powder after it is applied. Rarely, on account of itching, it is necessary to remove the plaster and allow the patient to go without it for a few days, when it may be reapplied. When, as usually occurs, relief is obtained from its use during the first period, an abdominal band may be ordered, or, in a clinic, where the cost is often prohibitive, the use of the plaster may be continued. Patients usually declare that the dragging sensation disappears immediately after its application, and the radiogram shows that the stomach is raised at least 4 cm., which probably accounts for the relief. The operative treatment and its results have been discussed. Before leaving the subject, however, mention must be made of the Enriquez pelotte, or an air cushion, which has been used by us with some success for the congenital cases which are not benefited by

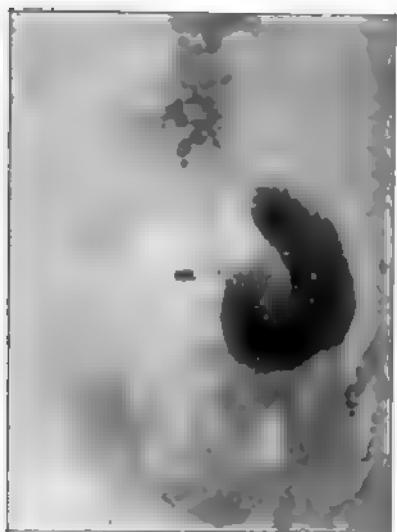


Fig. 75.—Radiogram of stomach before use of Enriquez air cushion.



Fig. 76.—Radiogram of stomach after six months' use of Enriquez air cushion.

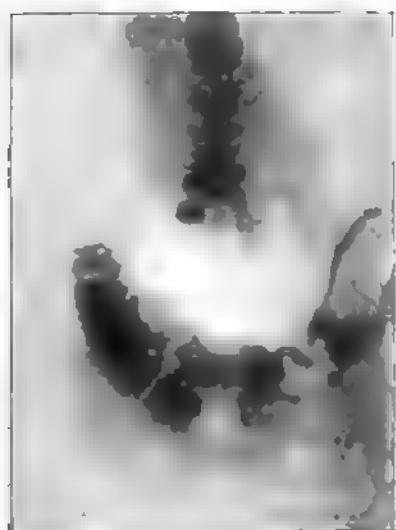


Fig. 77.—Radiogram of colon before use of Enriquez air cushion.



Fig. 78.—Radiogram of colon after use of Enriquez air cushion.

the usual form of binder. The former consists of a collapsible air cushion, which is inserted next the skin under an ordinary abdominal band, which must be well fortified by whalebone to prevent its stretching. The collapsible bag is placed just below the lower border of the stomach and then inflated with an air bulb to the point of comfort.

Some of the results reported by Borgbjaerg and Fisher, as demonstrated by radiogram both on the stomach and colon after six months' use, are admirable. The lower border of the stomach was raised at least 6 cm., even when before its use the same was 6 cm. below the level of the iliac crest, while at the same time the average gastric contents withdrawn before its use, six hours after a test meal, gave an average of 56 c.c., but after a month's use this diminished to 8 c.c. The colon followed the stomach, being raised from 7 to 8 cm.

CHAPTER XIV

NERVOUS DYSPEPSIA (GASTRIC NEUROSIS.)

In the use of these terms we concede at once that the nervous disturbance is general, with particular prominence placed on the digestive disorder either by the physician or much more often by the patient, or, what is still more curious, the patient has a new complaint at each visit to the clinic or doctor, which he emphasizes—now it is a burning sensation in the epigastrium, now an ache in the back of the neck, now insomnia, so that it is always a question whether we are dealing with a neurasthenic or a victim of functional gastric disease. This is not to imply that there is no pathology to gastric neurosis, because, in the three functions of secretion, motility, and change in sensation the patient is far removed from the normal individual in either one or more. Another thing which usually marks the possessor of a functional digestive disorder is the excellent state of nutrition. In spite of a tale of suffering which would convince one that he was in the last stages of dissolution, the color is usually good, though the patient may be pale, and, if persistent abstinence from food is indulged in for fear of distress after eating, moderate emaciation may be present. In probably no other line of diagnosis have modern laboratory methods been of such aid to the physician as in disentangling that vague group of symptoms known to Leube as nervous dyspepsia. Now we easily distinguish a group of secretory, motility, and sensation disturbances of nervous origin, which may be classified as follows:

1. *Disturbances of Secretion.*

a. Increase.

Intermittent.	}	Superacidity.
Digestive.		
Continuous.		

b. Diminution.

Partial suppression—Subacidity.

Complete suppression—Achylia gastrica.

2. Disturbances of Motility.

a. Increase.

Cardiospasm.
Pylorospasm.
Nervous eructation.
Vomiting.

b. Diminution.

Hypotony (gastric myasthenia).
Insufficiency of the cardia (rumination, regurgitation, etc.).

3. Disturbances of Sensation.

Bulimia (ox hunger).
Disgust for food.
Nausea.
Cardialgia.

SECRETORY NEUROSES.

a. **Hypersecretion.**—One must begin by acknowledging that this is only too often associated with chronic gastroduodenal ulcer, as the Mayos insist. Still, we have so many instances where at least all our frail efforts to detect an ulcer are in vain, and where, unless more light is shed on the question, we must continue to regard them of neurotic origin. Much oftener, however, we have the combination of delayed motility and hypersecretion, due, as is supposed, to the longer stay of food in the stomach. It nevertheless seems to us that those who attempt to prove that the stomach can secrete a gastric juice of varying hydrochloric acid content have failed, and to us, at least, an increase in the percentage of this acid means an increased secretion of the digestive fluid, with no greater change in composition than one would expect to find in the saliva when there is so-called salivation. There is probably no condition more common among this whole group of neuroses, and without the laboratory no one can tell whether hypersecretion or fermentation is the cause of the heartburn of which patients complain.

Symptoms.—The chief symptom, apart from the heartburn, or pyrosis, which is often located under the sternum, or among the more ignorant in the "heart," are eructations of sour-tasting fluid, beginning, some say, directly after eating, some later (one to two hours), and particularly after fatty or very highly spiced or salted articles are eaten. This symptom, as well as the burning, can be relieved by any

albuminous food, like milk or egg, or the old reliable cooking soda. The appetite remains excellent, or bulimia (ox hunger) often exists, nutrition is unimpaired; in fact, this condition is often found in the obese. When hunger cannot be at once gratified, patients begin to tremble, are extremely irritable, and are frequently in a fainting condition. The stool is usually scanty, and may occur every two to three days, which undoubtedly acts reflexly in keeping up the hypersecretion. Actual pain is rarely present, and, when it is well substantiated, should arouse the physician's suspicion that the condition is no longer a functional neurotic affair, but that actual gastroduodenal ulcer exists. Such pain comes on at 3 or 4 o'clock in the morning, but is not the typical "hunger pain" of Monyhan, since it is not persistent. As there is no measure for pain, it is often difficult to obtain from ignorant patients the degree of suffering, for it is customary for them to regard all discomfort as a manifestation of pain. The best proof, however, of the presence of hypersecretion is the existence of acidities exceeding the normal limits, which are usually given for an hour after the bread and water breakfast as 30-40 and 50-60. When these figures are exceeded, and the difference in the acidities is less than 20; when the residue by centrifuging is less than one-fifth of the total volume and the amount of hydrochloric acid in both the gastric contents, originally withdrawn, and the residue obtained from the wash water exceeds 80, then we may be assured that we are dealing with a digestive hypersecretion, and, if occult hemorrhage is lacking, that it is probably of nervous origin. When the fasting wash water contains hydrochloric acid freely without food fragments, we may regard this as continuous; and when this condition is only found at intervals, we may call it intermittent. Many patients have periodic attacks of hypersecretion, often accompanied by headache and vomiting, while in the quiescent periods they feel perfectly well. Seasickness, too, has been proven to be accompanied by hypersecretion. We must not, however, stick too strictly to our acid figures, for many, as stated, will suffer from subjective symptoms when the acid factors are under the limits given and others will experience no discomfort when they are far above it. The former, apparently, have a typical acid hyperesthesia, as Talma calls it. The intermittent form may also be associated with tabes, existing in the manifestations of the so-called gastric crises.

Treatment.—The treatment, no matter how energetic or of what character, does not diminish to any great extent the hypersecretion, except possibly, as has occurred often in our experience, to change the

continuous to the digestive form, thereby relieving the discomfort when the stomach is empty. The most one can hope to do is to render the mucous membrane less sensitive to these high acidities, for the organ persists in its exaggerated secretion. Here we reach the disputed question as to whether protein or amylaceous food is most fitted to diminish secretion. All physiologic tests on animals and normal humans are of little avail; the results derived cannot be transferred to the overexcitable glands of a hypersecretion. The only tangible way to settle this question is its application to those suffering from hypersecretion, and this has been done by Soerensen and Metzger, who employed a mixed diet, exclusive protein, and carbohydrate meals, with the result that practically no difference could be discovered in the amount of hydrochloric acid secreted. We are apparently between Scylla and Charybdis when we attempt to decide according to the older views, which are, that protein neutralizes acid, but excites a greater secretion, while amylaceous food excites less secretion, but is badly digested by ptyalin in the stomach. In spite of scientific views to the contrary, it has always seemed to us that mechanical influences played a great part in the incitement of the gastric glands to activity; the coarser the food taken, whether protein or amylaceous, the greater the secretion, and vice versa. Still, Bickel has performed a great service in determining by experiment those articles of food and drink which are mild or strong excitors of gastric secretion, and his table is as follows:

MILD EXCITORS OF SECRETION.

1. *Drinks*.—Water, alkaline waters, tea, cocoa (containing fat), cream, and white of egg.
2. *Condiments*.—0.9 per cent salt solution.
3. *Solid foods*.—Boiled meat, fats of all kinds, all boiled vegetables, potatoes, cabbage, asparagus, red cabbage, cauliflower, spinach, and white turnip, all in purée form.

STRONG EXCITORS OF SECRETION.

1. *Drinks*.—All alcoholic and carbon dioxide-containing beverages, coffee, fat-free cocoa, skimmed milk, bouillon, beef extracts, egg yolk, and hard boiled eggs.
2. *Condiments*.—Mustard, nutmeg, pepper, paprika, and salt in greater than 0.9 per cent concentration.
3. *Solid foods*.—Rare roast meat, dark meats, smoked and salted meats, black and rye bread (brown bread).

It is apparent that, as to diet, we must decide which we shall regard as paramount—the total acidity or the free hydrochloric acid. The former is undoubtedly lessened by the use of a largely vegetarian diet, but it is not the mixture of acid phosphates, which are necessarily increased by the excessive use of meat, and acid albumen, which cause no distress, but the free hydrochloric acid which produces the burning, as is proven by the fact that an attack of pyrosis can be allayed temporarily by white of egg, milk, or an alkali. Hence it would seem necessary to make protein a large factor in the diet in this condition, but it may be in the form of those articles of food which contain it other than meat. Furthermore, since it has never been proven that proteins increase the free hydrochloric acid beyond the period during which it is being digested, there is no reason to strike them from this dietary. Von Noorden has found that a diet containing an increased caloric value, without particular reference to the percentage of protein and carbohydrates, has worked best with the hypersecretors, and that on a purely vegetable diet the patient does not gain this increased nutrition, and, if associated with general nervous disturbances, his disorder becomes worse rather than better. In the obese hypersecretors, however, it cannot be denied that improvement sometimes results from purely lactovegetarian food, since this general nervous irritability becomes quieted and the special gastric symptoms are removed, although there is no proof that the excessive secretion becomes lessened. Hence an abundant mixed diet should be recommended, with plenty of albuminous food. Eggs, milk, cream cheese, and white meat of chicken or turkey should supply the protein needs of the body. These meats should be boiled, broiled, or baked, and prepared with little or no condiments. It is best to avoid the dark meats, roast beef, steak, chops, etc., because, according to Bickel, they do increase the secretion markedly. Fats are particularly advisable for hypersecretion, provided no gastric atony exists, because it has been demonstrated beyond all question that they do diminish secretion and their caloric value is greater than either of the other two varieties of food. Our success has been greatest with unsalted butter; the middle heavy cream, a half pint of which should be taken daily; olive oil, either drunk in wineglass doses several times per day or eaten on bread, as the Italians do; the yellow fatty cheese or emulsion of sweet almond oil, two tablespoonfuls before meals. The carbohydrates should be given in the form of white bread well toasted and vegetables in purée form, since in this way more diastasic action will take place before it is checked by the rising tide of acidity. The finer

forms of breakfast foods are also desirable, those made from wheat without cellulose, like cream of wheat, or Indian meal porridge being preferred, which also serve as a vehicle for large quantities of cream and sugar. Sugar also forms an excellent article of diet, arouses the secretion of the diluting fluid (alkaline), and thereby neutralizes much of the excess of acid. Our preference is for domino sugar or good chocolates, half a dozen of which should be taken in the midforenoon, midafternoon, and at bedtime. They are particularly convenient for those whose occupation does not allow them to leave their business for intermediate meals. Any cooked fruit or berries without seeds, cores, or peelings (jellies, sauces, etc.) are also beneficial, because they combat the constipation, which is so objectionable. Some find that cakes, pies, confections, etc., arouse an attack of pyrosis, but this is probably due to the poor fat in the one case and the nuts, dates, etc., incorporated in the other. Raw fruits, on account of their acids, or more particularly because the most of them in the market are plucked green (oranges, strawberries, and peaches) and are ripened on the journey to place of sale, are borne badly by these patients. Milk, or, what is better, egg and milk, serves admirably to neutralize the excess of acid, but should be taken as a supplementary meal and not at the three chief meals, where the food serves this purpose for two or more hours. Tea, coffee, alcoholics, and any more than the most moderate use of tobacco (two cigars daily) should be forbidden as being equally as injurious as the meat extracts. It is probably more advisable to allow only three meals daily, so as to keep the secreting structure at rest as much as possible, but, as patients often complain of burning between these meals, it is better to have three main meals, with a lunch between and at bedtime, to neutralize the acid. The constipation which so often accompanies this condition, and which is largely responsible for it in many cases, cannot be treated by purgatives, which always increase the secretion. At best we are limited to agar-agar, petroleum, milk sugar, or sodium phosphate, and, if these are not effective, we must employ an enema. Arranged in a table, the diet reads as follows:

DIET LIST IN HYPERSECRETION WITHOUT ATONY OR STASIS.

On rising.—A glass of Vichy or teaspoonful of sodium phosphate in a cup of hot water.

Breakfast.—Two eggs dropped on toast (two slices) or scrambled, or crisp bacon and baked potato, two balls of fresh butter, and some marmalade, cocoa made with milk.

11 a. m.—Two sandwiches spread thickly with cream cheese, or six pieces of chocolate candy or lumps of domino sugar.

Dinner.—Thick soup made with milk and flour (potato, pea, or cream of celery, etc.), a large slice of the white meat of fowl, or veal or calves' brain, or broiled cod or haddock, with two pats of butter; vegetable purée (spinach, cauliflower, green pease, or white turnip), a slice of toast or stale bread.

4 p. m.—A cup or bowl of custard, or the candy or sugar as at 11 A. M.

Supper.—An omelet or picked fish or sardines, milk or buttered toast, or stale rolls with fresh butter, cocoa made with milk.

Hot baths or applications of towels rung out of hot water will sometimes allay the burning sensation when it comes on at night, but, other than this, hydrotherapy has no influence over the secretion. Lavage is worthless unless the hypersecretion is of the continuous variety—i.e., gastric juice is found in the fasting stomach—or there is stasis; accompanied by myasthenia, lavage is worse than useless to change the character of the hypersecretion. To control the secretion, nothing has ever been discovered better than belladonna and its alkaloid, atropine, or modifications of the same—eumydrine and methylatropine bromide, the latter in doses of 0.001-0.004 gram ($\frac{1}{60}$ - $\frac{1}{15}$ grain). The alkalies will be found necessary to relieve the patient's distress, but nothing curative can be expected from them alone. Several examples have been given of these alkali mixtures under medicinal treatment (page 265). Many recommend Merck's magnesium perhydrol, in doses of 0.5 gram (8 grains) in the form of tablets, of which one is to be taken at the high tide of secretion, usually two hours after eating, or, if relief is not obtained, two tablets may be given. Others have recommended the use of hydrogen peroxide, of which a teaspoonful of the 3 per cent solution in a glass of water is to be taken fasting. In 80 per cent of all cases the latter is said to bring relief.

b. Diminution.—Diminution of secretion easily divides itself into subacidity, or hypochlorhydria, and an acidity, or achlorhydria. These are mere terms, and the whole classification is based entirely on the activity of the peptic glands of the stomach. This condition is undoubtedly brought on by nervous depression, and varies merely in degree. When there is absence of hydrochloric acid and diminished but still existing ferments, the above terms are used, but, when both hydrochloric acid and ferments vanish, we choose to apply the terms originated by Einhorn—achylia gastrica. All these nervous disturbances affect the secretion of gastric juice, but apparently its hydrochloric

acid more than its ferment constituents. While the nervous character of this suppression will often in a blooming, well-nourished individual impress itself on one at once, it is never justifiable to take its functional character for granted until all means have been employed to exclude organic disease, like gastritis or cancer.

Symptoms.—The symptoms are largely pressure after eating, loss of appetite, and bad taste in the mouth. Quite often there may be sour eructations, but very late in digestion and due to the fatty acids. There is almost an instinctive demand for articles of sour food, lemons and pickles being the favorite, or some patients state that they drink vinegar with satisfaction. The diagnosis can be established only by several examinations of the gastric contents, by which hydrochloric acid is constantly found wanting; there is no excess of mucus, the ferments are found present, but diminished, and the total acidity, though lessened, does not reach the low limit of achylia gastrica (10–15).

Treatment.—The treatment is, of course, directed toward endeavors to increase the flow of gastric juice, and, as the exciting cause is of nervous origin, change of scene, if possible, is advisable. One of the most important objects to accomplish is to gain the confidence of the patient—to learn the source of the trouble. Disappointment in love, jealousy, and suspicion of a husband unusually attentive to ladies, or chagrin at being childless, have all come within our observation, and just here the Eddyites and Pentecostals succeed where the doctor fails. Pawlow has discovered a list of articles of food which are unusually active in promoting secretion, and our patients should be urged to employ largely in their diet, raw scraped beef, bouillon, compressed beef juice, the meat extracts, milk, and gelatine, while abundant water drinking can also be recommended. Condiments, too—pepper, mustard, catsup, salt, etc.—are useful in exciting the flow, and should be used freely with food. A small quantity of alcohol is also desirable after meals, which exercises the same influence. Of medicines, only hydrochloric acid or acidol has any influence on this condition, and should be given in large doses until hydrochloric acid appears in the gastric juice. The morning cold plunge is also of benefit, whether acting as a stimulant to the nervous system or on secretion directly is difficult to say.

ACHYLLIA GASTRICA.

Achylia gastrica is characterized by a complete failure of the gastric juice, both hydrochloric acid and ferments being lacking; hence the

more proper term would be *apepsia gastrica*. We must recognize three distinct types of this anomaly, dependent on its causes:

1. The congenital form, which results from weakness of the peptic glands.
2. An acquired form, already described, which is due to gastritis, or the atrophic form accompanying cancer, in which the glands are probably destroyed.
3. That resulting from pernicious anemia.
4. The neurotic form, which accompanies nervous dyspepsia.

The differentiation of these four forms may be very difficult, for neither the symptoms nor the gastric findings differ.

Symptoms.—The symptoms may be variable or utterly wanting, the reason for which is, as has been often mentioned, that the duodenal digestion may compensate fully for a faulty or lacking gastric one. To accomplish this, however, we must have a perfect gastric motility and a normal duodenal digestion. Just as soon as the motility begins to flag and food in a state of partial fermentation makes its entrance into the intestine, then diarrhea is often set up, (gastrogenous), which produces so much emaciation that, with the other symptom (absence of hydrochloric acid), we may look on our patient as a victim of cancer. An examination of the stool will show large quantities of connective tissue, which ordinarily arouses at once an inference of lacking gastric juice, since by that alone, and not by the pancreatic juice, can this material be digested. As explained under examination of feces, this is not the only cause of undigested connective tissue, but it is the most common. We have, in addition, the old symptoms, with so many interpretations—pressure and distention after eating, also a well-defined moderate stabbing pain a couple of hours after the meals—which reminds one of hypersecretion until the gastric contents are examined. This dolorous sensation is said to be due to the mechanical action of the coarse unliquefied food fragments upon the gastric walls. Pyrosis and acid eructations may also be present one to two hours after food is taken, also making one think of hypersecretion until the examination clears the matter up. Occasionally, too, the achylia causes no discomfort and is only accidentally discovered. In two-thirds of all instances there is no irregularity of the bowels, but there may be constipation, and very rarely we may have these persistent diarrheas, so that in case of the latter it is always our custom to investigate the gastric digestion. As often mentioned, the hydrochloric acid stimulates the flow of pancreatic juice, and, when this is absent, we may have also a veritable achylia pancreatica and the feces show many split and unsplit fat

particles, meat fibers, starch remnants, and the retention of connective tissue nuclei. One is also astonished at the enormous amount of stool passed by an achylie. The nutrition suffers because of this great loss of nutrient matter, but Ley, who followed the history of ninety-one achylies, could not find that it shortened their lives to any extent. Furthermore, he emphatically negatived the statement often made, that the loss of gastric juice caused pernicious anemia, by stating that the sequence was always reversed—i.e., the anemia was primary. Again, the suspicion that cancer might arise from achylia was negatived, since, in an observation of fifty achylies over 40 years of age for periods of one to fourteen years, he had never seen a gastric cancer arise.

The appearance of the gastric content in an achylie is very characteristic. It can barely be made to run through the tube, and often only a few cubic centimeters can be removed, or the tube must be withdrawn with a closed end, when a little will be obtained, in which the bread is simply softened, but not broken up, just as if it had remained in water for the same period it was in the stomach. The inference that the gastric motility is increased and the rest of the meal has passed into the duodenum is not justified, for, if the tube be reintroduced and the stomach washed out, all the bread will be found; in fact, based on the discovery of Cannon, that the pylorus does not open until free hydrochloric acid is established, it has always seemed to us that motility was very much delayed. Usually the gastric juice will show an acid reaction to blue litmus, but the total acidity will rarely be above 2-4; the free acid, pepsin, rennin, and mucus are all wanting, and in this absence of mucus we have our best guide in excluding gastritis and early cancer. On account of the vulnerability of the mucous membrane, we may often have small traces of blood in the gastric contents, but never in the feces, according to our experience. Lactic acid is sometimes found, but never in our observation when it could not be found equally as well in the bread used for the test breakfast. Taken altogether, the absence of hydrochloric acid and ferments, the presence of lactic acid and a trace of blood, together with the emaciation, may so confuse one that some study of the progress of the disease may be necessary to exclude cancer in those well advanced in years. Once it has fallen to us to recommend an exploratory operation in such a case, which disclosed nothing abnormal in the stomach, and the same experience has fallen to others, and we are both justified, for under analogous circumstances the same practice of early exploratory operation has enabled us to "nip it in the bud" an early cancer. The purely

nervous form is usually accompanied by symptoms relating more to the unstable nervous equilibrium—like headaches, sleeplessness, and easily aroused agitation—than to the stomach, though loss of appetite often exists. In this nervous form, too, the suppression of the gastric juice is not permanent, as on repeated examination we will, without any warning or change in the patient's nervous condition, find a sudden return of the hydrochloric acid and ferments, so that the achylia is only a symptom rather than the source of the nervous manifestations. When we find this heterochylia, we may conclude at once that we are dealing with the nervous or functional variety.

Treatment.—The treatment is, first of all, dietetic, which should consist in an effort to present the food in such a finely divided condition that as little delay as possible shall take place in the stomach, for, as stated, if motility is unimpaired, patients do not apparently suffer from this absence of gastric digestion. This does not preclude the use of meat, but it should always be employed in the form of hash, minced, or as Hamburger steak, lightly broiled and served with butter, much as was suggested for ectasia. Peptones and albumoses have been recommended, but are undesirable in any amount, for they are bitter, and no patients are more finicky about the flavor of food than achylies, and, in addition, these predigested proteins are liable to incite the diarrhea, which is so common in this disease. Much more desirable are the grain, casein, and meat powders, like gliadine and laibose, which may be taken on bread well spread with butter, in milk, soup, etc. The carbohydrates, unless in the finest form, also suffer in their digestion because the digestive juice is lacking to attack the gluten, so that the ptyalin may assail the starch. As long as the motility is unimpaired, we may add fats in the form of cream, butter, and milk, and in the form of thick soups, bowl custard, ice cream, etc. These means are employed simply to offer the duodenum properly prepared pabulum for its activities, and not to restore the secretion of the gastric juice, which is equally beyond our control, whether of the erratic nervous variety, which comes and goes as it will, or the congenital type, which never returns. During the periods of diarrhea special care must be taken of the diet, which for a few days may have to be restricted to barley and sago soup, boiled milk, and flour gruel. Nothing can be more unjustified than that physicians should give raw scraped meat to overcome the anemia of an achylie, when the six to eight daily movements of the patient are made up almost wholly of meat fiber and connective tissue, as has come within our observation. The diet best adapted is the one given under Chronic Gastritis, with suppression of

hydrochloric acid (page 302), since motility is not impaired in either condition and need not be taken into consideration. In all cases where secretion fails, only large doses of dilute hydrochloric acid are indicated—not to restore the lost secretion, but to stimulate the pancreas to greater activity and to check the diarrhea, for which it is the best remedy. Cold baths and sprays will alleviate these associated nervous sensations, but will not help the gastric condition, and, in our judgment, pankreon and extract of pancreas are not called for unless there is a marked fatty diarrhea, which sometimes occurs.

DISTURBANCES OF MOTILITY.

Disturbances of motility separate themselves naturally into increase and diminution:

a. **Increase.**—An increase may be found in a number of conditions, which are generally termed by the laity either "cramps" or "heaving," since they manifest themselves either by pain or vomiting.

Cardiospasm.—Cardiospasm is, perhaps, the most common condition found in a large clinic, where it is variously complained of as a sticking of food in the throat and pain in the heart, arousing in the patient's mind suspicions of cardiac trouble, but coming after meals and not on exercise. The exciting cause is often hasty eating, swallowing of fluids rapidly with the admixture of large quantities of air, and the ingestion of hard fragments like an unmasticated crust of bread may bring it on. This cramp of the cardia is seen to perfection in hysterics and neurasthenics, in whom after previous nervous disturbances an attack may come on. These attacks are extremely sudden, and consist of a drawing, tearing pain, experienced under the breastbone and extending to the backbone. The spasm may be relieved in a few moments or may be succeeded by others, and whether the effect is due to the ability of different patients to withstand pain it is difficult to say, but the appearance may vary from a sense of vague discomfort to actual suffering, in which perspiration breaks out profusely on the victim's face. As long as the spasm lasts the sufferer makes constant efforts at vomiting until at last an eructation of gas, or the discharge of some fluid containing mucus, with a few food fragments, brings relief, which is aided by hot carminative (peppermint) drinks, or it may be necessary to employ morphine. The opinion of many, that above the contracted portion of the esophagus food may accumulate and by stagnation produce secondary esophageal changes, is probably unfounded when the spasm is purely of functional origin. The great error in our way in such cases is to accept

them always as functional, which, of course, in the vast majority they are, but the exceptional case is due to ulcer or malignant disease of the cardia, and every physician must experience some chagrin when he learns that he has left the true condition to be discovered by another. In all cases of cramp of the cardia, whether a mere lump in the throat is complained of or an attack so severe that it may arouse suspicion of angina pectoris, it is our invariable custom to pass the tube, and, if the narrowing is functional, the largest tube will pass as readily as the one of least caliber, but not so if organic disease is present, where the smallest one reaches the stomach best. Streaks of blood on the end of the tube also establish promptly the diagnosis. A radiogram is of great assistance in diagnosis, but is not to be relied on implicitly.

Treatment.—The treatment is often begun and ended with the passage of a large sound or tube, for the fear of obstruction in the esophagus is an important element in continuing the difficulty. After one attack the patient should be warned against hasty eating, rapid drinking, or swallowing hard masses, as well as very hot or very cold fluids. When ulcer or fissure of the cardia exists, the ulcer treatment must be employed. Our only case of this character showed the peculiarity of clear wash water at first from the fasting stomach, which quickly changed to blood-stained fluid on employment of successive portions of water, while the feeling of constriction and pain was midway of the sternum and just to the right of it. The treatment of the purely functional form is undoubtedly the introduction of large sounds, which are allowed to remain sometime, or recently a collapsed rubber ball has been devised which is introduced into the stomach, inflated and withdrawn, thereby markedly dilating the customary point of contraction. A wineglass of oil before each meal will help, while belladonna, bromide, and validol allay the symptoms. These cases are, many times, obstinate and only by improving the general health of the patient can a cure be attained.

Pylorospasm.—Pylorospasm, or painful spasm of the pylorus, is apparently either primary, dependent on hypersecretion, particularly when the stomach is free from food, as in the early morning hours, a condition which is denied by some; or secondary, due to fissure or ulcer situated at the pylorus. The excess of hydrochloric acid, however, plays an important part in its production, for it is vastly more common when the acid is in excess than when absent—for instance, in the later stages of cancer. The older view that a spasmodic contraction of the pylorus occurs, by which the food, remaining longer in the stomach, produces hypersecretion, will have to be given up, for the consensus of

opinion is that hypersecretion is primary and the contact of the excess of acid with an erosion causes repeated long continued and painful closure of the orifice, by means of which stasis and increased peristalsis of the stomach may arise. It is also very possible, as previously explained, that the fissure itself produces hypersecretion, so that a vicious circle results. That this, in turn, may lead to ectasia is possible; that any purely functional increase in the secretion of gastric juice may ever lead to such dire results is improbable. At the times of examination there may be no difference in the dilatation produced by organic pyloric narrowing and spasm from fissure, but the latter condition may improve and stasis temporarily disappear, but the former condition is permanent.

Symptoms.—The symptoms consist of a boring, burning pain in the epigastrium, which extends to both sides along the costal borders to the back, so intense that vomiting results either from the pain or from the increased peristalsis of the stomach, which find a less resisting obstacle at the cardia than at the pylorus. The vomitus is excessively acid, and, after the act, relief is usually obtained. In earlier days we used to consider these attacks as manifestations of some of the various forms of neuralgia, hence called gastralgia, particularly when vomiting did not occur, but they probably all have the same pathology. On account of the late appearance of the pain after food is taken, the patient is often thought to be suffering from duodenal ulcer, but there is no regularity in the former as there is in the latter. When marked stasis occurs, as demonstrated by the presence of sarcinæ, it seems to us that it cannot be due to these spasmodic contractions, but to true stenosis.

Treatment.—The best treatment to employ is that given for real ulcer, consisting of rest in bed and the appropriate diet. This has brought relief in our practice when the patient had actually been removed to the hospital for a gastroenterostomy and a few days had been allowed to elapse before the operation. The oil treatment has also been very effective in staying the attacks of pain, whether by its soothing effect on the lesion or lessening the secretion cannot be stated with accuracy, although the repeated examination of gastric contents shows no diminution in this secretion. If the patient objects to the use of the oil, which has never occurred to us (a half glassful being taken readily), it may be put up in the form of an emulsion with menthol, or use the emulsion called egmol, which has only one disadvantage—the presence of a small quantity of brandy. As moderate emaciation is usually present with these repeated attacks of pyloric spasm, the oil

fulfills a second indication—the improvement of nutrition. The purely neurotic form of spasm, if such exists, cannot be at once differentiated, and such treatment may be employed, but usually with little relief, so that one must have recourse to the usual means of allaying hyperexcitability of the nervous system—validol, bromide, hot hip baths at bedtime, and every means for improving the nutrition of the patient. Apart from the persistent use of oil, the diet will not differ from that given for ectasia with hypersecretion (page 331).

Eructatio Nervosa.—*Eructatio nervosa* (aërophagy) consists of loud explosions of gas from the esophagus, which may or may not come from the stomach, because some individuals can draw the air into the former and eject it without its entering the stomach at all. This is entirely different from the almost silent eructations of fermentative or putrefactive gases, as is found in those suffering from actual gastric disease. The true nervous eructations take place without any reference to food, though more apt to occur directly after eating, especially when that act follows anger, grief, or fright. The act must always be accompanied by previously swallowed air, whether the patient is conscious of it or not, but if such patient is told to "belch" (the usual term employed) without his mouthful of air, he cannot accomplish it, and calling his attention to this may break up the habit. There is always a concomitant feeling of distress in the stomach, which the victim tries to relieve. This is a little different from the second variety, where the air swallowed is held by the spasmotic closure of the pharyngeal muscles until the tension in the esophagus and stomach exceeds their strength, when a gatling gun series of explosions occur until the tension is relieved. Our earliest recollection is of an elderly woman who used to go outside of her cottage after supper, and while standing there made the welkin ring with her explosions, which in the still night air of a quiet farming district was doubly effective and aroused much sympathy among her neighbors for the sufferer, which is probably why she chose the open for her act. These attacks are apt to occur at regular intervals during the day, but never at night. The act of swallowing the air is so imperceptible that it almost escapes the observation of the patient, but, if his attention is called to it and he is fairly intelligent, he may detect his act for the first time. This ingestion of air can be much more easily determined with a stethoscope placed over the epigastric angle or in the back, when the air bubbles can be easily heard descending the esophagus in a series of gurgling sounds. It has seemed to us that sufferers from gastric atony and ptosis were oftener victims of this habit than any others, and Linossier believes that an aspira-

tion of air can take place by which it is drawn into a relaxed stomach on descent of the diaphragm with closed glottis just as into the bronchi. The frequency of these paroxysms varies greatly. In the case mentioned, once a day sufficed; others indulge in only an occasional and single act, but not enough to induce them to consult a physician; others, on the contrary, constantly feel distention in the epigastrium, and are relieved by a paroxysm, when they begin the succession of swallowing again, like a pouter pigeon, until they avoid their friends from chagrin and life becomes a burden to them. When this ingested air can be easily ejected, perhaps no harm comes from it, but the condition is often associated with cardiospasm, and then the gastric distention may become very painful; the pressure can be roughly estimated by the roar of air which meets one when a stomach tube is introduced. Furthermore, there may also be associated an intestinal flatulency, which causes great discomfort and which is relieved by the free passage per anus of gas, which is absolutely nothing more unquestionably than swallowed air. Another complication of this ingestion of air is the pressure exerted upon the heart, which causes intermission of its beat and thereby alarms—beyond measure the excitable patient. In the clinic we often see cases where dyspnea and mild asthmatic attacks occur dependent on nothing else than distention of the stomach by this swallowed air.

Treatment.—The treatment of aërophagy may be either the most satisfactory or the most difficult that can be imagined. If the patient is intelligent and can be shown that only that air is ejected which is swallowed, then a little practical instruction will often cure the individual. In the ignorant class, however, it is impossible to convince them that they do swallow air, and they always insist that they obtain relief from their efforts at ejection. If asked, however, to eject with the mouth open, the dullest patient will soon see that it cannot be done. Zweig recommends what he calls "compression massage" of the stomach, which consists of compressing the stomach with both hands firmly during expiration and then have the patient breathe deeply ten to twenty times with the hands in this position. If this suggestive treatment is of no avail, then we must employ all the means of modern treatment of the nervous condition, consisting of sedatives, hydrotherapy, massage, and electricity. In the better classes this treatment can be carried out only in a sanitarium, where very often its effects are most brilliant. Without this we have to rely largely on validol, sodium bromide, and chloroform water, which at least relax the spasm of the pharyngeal muscles and allow the air to escape readily. For

the most obstinate cases, only the repeated passage of the stomach tube or sound will avail, which, as one can readily see, is merely a method of suggestive therapeutics. When the patient is reduced in flesh, very often a process of overfeeding, by which a few pounds are gained, will also succeed.

Nervous Vomiting.—Nervous vomiting is caused either by cerebral or spinal agencies, or may be wholly reflex. Cerebral vomiting is often found in pathologic conditions of the brain and its envelopes (tumor, concussion, meningitis, etc.), intoxications (opium, morphine, and tobacco), as well as in nephritis (uremia). Vomiting of spinal origin is almost invariably the result of tabes dorsalis, generally termed gastric crises. This last is characterized by severe pains in the epigastrium, with persistent vomiting that may last from two to three days and produce in the patient the most intense prostration. The attacks may follow each other in rapid succession, or periods of a month may elapse between them. During the interval the patient usually feels in perfect health, and if examined during this time we may find all the stigmata of tabes, ataxia, sluggish pupils, and inability to stand erect with eyes closed, or none of these may be elicited. This nervous vomiting may be one of the earliest symptoms, and the other evidences of sclerosis occur months, or even years later. A case came accidentally under our observation where the appendix had been removed, and an exploratory operation with the ultimate intention of establishing a gastroenterostomy for a suspected pyloric ulcer had been performed without any evidence of scar, in whom later the clear, unmistakable signs of tabes were found. Many of these patients, too, have the appearance of the habitus asthenicus, and it may be interesting to observe whether those patients, when later tabes develops, are especially inclined to these gastric crises. Similar gastralgie attacks have been observed in sclerosis of the spinal cord or in myelitis. It is for us, however, to deal only with those cases of nervous vomiting which occur in hysterical and neurasthenical individuals, bearing in mind always the possibility of confusion with reflexes from actual disease of the spinal cord. Many instances, too, occur where, like the concomitant nervous dyspepsia, the reflex comes from diseased genital organs. In children, also, we may observe this periodical vomiting, accompanied by a marked acetone odor of the breath, in whom not a single evidence of real gastric disease can be discovered. These small patients often show signs of extreme pallor as well as widely dilated pupils, and the heart beats diminish to six per minute,—all evidences of a marked vagotonus. Such children, provided they are of school age, should be

immediately removed from school and given the most energetic roborant treatment possible, with special attention to diet, which should include an increased proportion of fat. The true nervous vomiting is particularly noted for the ease with which it occurs, its freedom from nausea, the blooming and well-nourished appearance of the victim, and its lack of dependence on the nature or quantity of the food. Its causation by shock, anger, or grief, with entire absence of an anomaly of motility or secretion on the part of the stomach, is also characteristic. It can be readily seen, however, that one should never make a "snap" diagnosis of nervous vomiting without having carefully examined the nervous system, the stomach, and genital organs.

Treatment.—The treatment is most unsatisfactory, and can practically never be successfully carried out without the removal of the patient from his family surroundings to a health resort or to a well-conducted sanitarium. Friends should be forbidden admission to the patient, and the diet should consist at first largely of milk, taken in tablespoonful quantities, and the victim should remain in bed. Sodium bromide in gram (15 grains) doses three times per day and the occasional passage of the stomach tube or sound will overcome the irritability of the vomiting centers. If these milder means fail, one can always have recourse to atropine sulphate, of which 1 milligram should be injected daily, and the hypodermic method is always more satisfactory because of its suggestive therapeutic effect. The remarkable effects of atropine treatment in checking nervous irritability was first brought to our attention in the many Keeley cures which were established at one time, and in which, not the popularly supposed "gold," but atropine, was employed. Still, to our sorrow, it must be confessed that, with most energetic treatment, these patients under the slightest nervous disturbances will again begin to vomit.

b. Diminution.—Gastric atony is one of the commonest of the ills of the dyspeptic. It may be due either to a weakness, by which the stomach cannot close firmly on its contents, or an inability of the organ to force the food into the duodenum, by which it remains an undue length of time in the former. This period is only relative, however, for the fasting stomach in the morning is always free from food remnants, a factor which differentiates this condition from the true dilatation, where there is always a morning residue. This condition never exists alone, but in conjunction with a general loss of tone of both nervous and muscular system, and may be induced by long illnesses, like typhoid, tuberculosis, syphilis, and suppuration. Then, again, we see many cases where no cause can be found, and from complaints of dys-

pepsia and persistent constipation since childhood we are forced to believe that the predisposition is congenital. Atony may also accompany gastric ulcer, intestinal and gastric catarrh, and cholelithiasis, but the atony is always primary, dependent on general loss of muscular tone.

Symptoms.—The symptoms comprise, first, an early sense of fullness in the stomach long before the appetite is satisfied and a following period of pressure and discomfort—as patients often express it, “a slow digestion.” Then, too, there are often eructations of air, or at times a mouthful of food will be brought up a long time after the meal is taken. Patients also declare that after the usual interval between meals (five to six hours) they are conscious of food still remaining in the stomach. Vomiting, too, may occur when too hearty a meal is taken, but is not at all constant. Headache, and particularly dizziness or vertigo, may be experienced when a change of position from the prone or sitting to the erect takes place, and they may also have a fainting sensation under similar conditions. Insomnia may accompany, and the victims are always undernourished. Many of these patients show the physical signs of enteroptosis, flat abdomen, long, narrow chest, and acute substernal angle. Yet, we must not lose sight of the fact that an occasional atonic is found who is well nourished, has a normal build, and abdominal organs in their usual site. The size and position of the stomach can be best elicited by the succussion which in these patients can be easily aroused on account of the thinness of the abdominal walls. Even when the stomach is in its normal position, slight relaxation of its walls will bring its lower border somewhat below the usual site. Still, the mere presence of succussion alone cannot be utilized to diagnose an impaired motility. Atony is always understood as a condition in which food remains an unduly long time in the stomach, so that an hour after a test breakfast we do not find the usual 150–250 c.c. according to the method of determining the total contents given on page 140, but a much larger quantity. No diagnosis of impaired motility should be accepted unless this increase occurs. Zweig and Elsner have found that only 50 c.c. of fluid are sufficient, in conjunction with air, to produce loud succussion sounds over the stomach, so that both factors, increased volume and these sounds, must be present for a diagnosis. Then, too, the increased volume does not necessarily mean atony, for in hypersecretion there is always a large volume, and those so affected may emit loud succussion notes without impaired motility. Furthermore, it is not unusual to find increased volume of contents and loud succession in ectasia, with pyloric stenosis, where the motility is increased to such an extent that rigidity may be observed.

In short, we may say that the conditions in impaired motility are directly the reverse of those in hypersecretion—that is, the difference in the acidities is greater than 20. The residue by centrifugation is two-fifths or more of the total volume, and the hydrochloric acid in the contents withdrawn and the wash water is less than 80. The mere relative amount of hydrochloric acid may be normal, or slightly increased on account of the greater stay of the food in the stomach. As stated, the morning fasting stomach must always be free from food, but to obtain the actual degree of impairment we may give a Riegel meal and remove the contents six to seven hours afterward, when the normal stomach should be empty. The atonic stomach also shows certain peculiarities under the x-ray examination. The buttermilk holding the bismuth in suspension falls promptly into the caudal end of the stomach without filling the organ fully; there is a much larger air bubble at the summit, and the stomach requires a much longer period than usual to empty itself. Atony of the stomach is very erratic in its behavior. We have periods of perfect health until some mental strain or shock—loss of relatives or a slump in the stock market—brings on another period of dyspeptic symptoms. It has always seemed to us that if the weight of the individual prone to atony could be maintained, this was always the best insurance against the digestive manifestations. As stated before, the outcome of atony is never dilatation, except in those rare instances where a congenital gastrophtosis causes a kinking of the pylorus and difficulty in the egress of food. All that can be done to avoid the ill results of myasthenia gastrica is to induce individuals thus afflicted, recovering from acute illnesses to begin, at the earliest date which is safe, with an abundant diet containing a large percentage of fat, and induce women after confinement to demand their two weeks of rest in bed and a week more for good measure.

Treatment.—The treatment of atony resolves itself into one almost wholly of overnutrition. This is, however, no easy task for the patients are lacking in appetite and fearful of food because of the distress it causes them, and, from restrictions imposed by physicians or self-imposed, are always undernourished. If complete change in occupation and surroundings cannot be made for a time, which is often impossible for business reasons, one must be very peremptory, almost schoolmaster-like, in directions and injunctions, not only to the quality of food, but also as to its quantity. Then, too, the long-continued habits of the individual, often as well grounded as the laws of the Medes and Persians, have to be changed, and often against the protests of the invalids, who insist that never in a long life, of which the years

are usually stated with emphasis, has a luncheon ever been indulged in. Now, the intermediate small meals or lunches are the basis of hypernutrition, and must be insisted on. Therefore, finally the patient, in a resigned voice, consents, but with the reservation that the evils confidently believed to accompany the revolution in habits will rest on the physician's head. Some propose an exclusive milk diet, three and four quarts daily being recommended. Now, no nervous dyspeptic, whose main complaint was atony, ever received the slightest benefit from these large quantities of milk, as its bulk is absolutely opposed to a weakened musculature which must pass it along. A dry diet has also had its advocates, but, as shown under Ectasia, the stomach can provide sufficient diluting fluid and gastric juice to bring up the volume at the end of an hour to the same amount, whether dry or liquid food is taken, so that the former has no advantage. The diet, then, must contain the three ingredients—carbohydrates, fats, and protein—but particularly the latter two, and in such form that their passage through the stomach should not be delayed. Vegetables mashed, fruits cooked, meats and fish hashed or minced, and bread toasted, announce the program in the fewest words. Black (rye) bread, brown bread, baked beans, sourkraut, cabbage, mushrooms, potato salad, and pickles had best be avoided. Beverages should be limited to three pints daily, and may consist of milk or water, of which not more than a glass should be taken at a time, and preferably not at meal times, but between them, so that the weakened musculature shall not be overstrained. Our best results have always been obtained when no fluid at all was taken at meal time, but at least thirty minutes were allowed to elapse before drinking. Very often a compromise can be made with patients by which they defer the use of beverages until the act of eating is completed. Alcohol, according to Klemperer, improves the motility, and a little wine may be taken, provided hypersecretion does not accompany the lack of motility. Beer is much more objectionable on account of its volume, and for the same reason soup is worse than useless because the amount of nourishment derived is not commensurate with its volume. As it is a well-established belief that the stomach empties more rapidly when its possessor is lying on the right side, this is usually recommended for thirty minutes after meals, but, as these patients are rarely bedridden and often engaged actively in their occupations, it is difficult to carry out except after the evening meal, which among many is the most substantial one of the day. Our belief is, if the patient is weary or agitated, a short rest on a couch *before* the meal is more effective. When possible, actual forced feed-

ing should be attempted, with the first two meals in bed, after which the patient may arise and indulge in moderate exercise, but not directly after a hearty meal, and bed should be sought early. If, however, the patient remains in bed all of the time, appetite will flag, constipation is exaggerated, and the individual becomes still more nervous. In arranging a diet, attention must be paid to the character of the gastric secretion (increased or diminished) and the condition of the bowels. Where the patient can give up his occupation, the diet list given for malnutrition (page 225) works admirably; when not, and constipation exists, the following is advantageous:

DIET LIST IN GASTRIC ATONY WITH CONSTIPATION.

On rising.—A glass of cold water with a tablespoonful of milk sugar dissolved in it.

Breakfast.—Orange, apple, grapefruit, or grapes, or any kind of cooked fruit; salt codfish in cream, or finnanhaddie, or salt mackerel, or crisp bacon, with a baked potato and abundant butter; some toast or rolls, with abundant crust, or French bread, and some marmalade, jelly, or honey; small cup coffee.

Midforenoon.—A glass of buttermilk or tablespoonful of milk sugar in a glass of water.

Dinner.—No soup, three heaping tablespoonfuls of minced lean meat or fish, mashed vegetables (potato, squash, spinach, young pease, or cauliflower); some stewed or canned fruit without seeds, or a light pudding (rice, tapioca, or sago), with a sauce containing fruit juice (lemon, orange, or berry juice from canned fruit); rolls and butter.

Midafternoon.—Same as forenoon.

Supper.—Scrambled eggs, fish hash, cornbeef hash, sardines, soft cheese (Brie, Camembert, or cream); rolls and butter and some cooked fruit; weak tea if desired.

Bedtime.—A tablespoonful of milk sugar in a glass of water.

The dinner and supper can be interchanged if desired. Nothing should be drunk until the meal is ended, and great care should be taken to eat slowly.

As the stomach becomes accustomed to take up its increased burden, the amount taken can be increased imperceptibly. A half pint of middle heavy cream can be added, to be taken on baked potato, added to the buttermilk and poured into the tea and coffee generously, or eaten on the fruit. Butter can be added in large quantities to the mashed vegetables. In the meantime the feelings of the patient are not to be your guide, but his weight, and, if this steadily increases,

success is assuredly in sight. As to hydrotherapeutic measures, our experience has been that, if continuous secretion does not exist with the atony, lavage is worse than useless, but the cold spray over the epigastrium or even the plunge works extremely well. In the poorer practice, where a spray is not available, dashing cold water upon the abdomen as on the face makes a fairly good substitute. All of these procedures seem to strengthen the muscles of the stomach, so that the residue six to seven hours after a Riegel meal grows less and less. The faradic current from a good transformer also aids; whether by suggestion or by actually increasing the muscular contractions cannot be told. The external application works just as well as the intragastric of Einhorn and is much more convenient.

Massage has been found particularly valuable in this disease of the stomach; whether by increasing nutrition or by actually stimulating the peristalsis cannot be stated positively. It seems to make no difference whether we employ the manual or mechanical variety, and the small Johansen instrument, described under Treatment, can be made to do all that is required. The use of mineral waters has no place in the treatment of this condition; in fact, has never failed in our experience to make the failing motility worse. Of medicaments which will benefit it we have none that have proven their worth. There are many, however, that can be employed and are recommended by different authorities. Orexin tannate (if no hypersecretion exists), resorcinol, creasote, and nux vomica can be used, but to us they have all seemed futile without the hydromechanical therapy and the diet. Sadly must it be acknowledged that, like the shotgun therapy of old, it is difficult to say which of these agencies is the most effective, but the disease is so obstinate that, with all your means of attack—foot, horse, and artillery—one can make but slight impression on it after a long siege, during which the patient, wearying of the treatment, often seeks another physician. It will be found necessary at times to try to overcome the pressure and discomfort after eating in order to induce the patient to continue the hypernutrition mode of treatment, the only effective one known to the author, and validol and anesthesin, already mentioned, will be of great aid in rendering the stomach more tolerant of its burden. The constipation which almost invariably accompanies gastric atony, and may be due to an associated atony of the intestine, must not be treated by strong laxatives, which invariably increase the failing motility of the stomach. At best, only the milder articles, like agar-agar and petroleum, may be used, while our chief dependence is placed on diet and enemata.

Insufficiency.—Insufficiency or relaxation of the cardia, though often a symptom of nervous dyspepsia, may be the sole symptom, and rarely deserves consideration under those circumstances as an entity. While the cardia should normally close against the peristaltic action of the stomach allowing perhaps only gases to escape, it often permits the food to rise into the esophagus or mouth, where it may be ejected (regurgitation) or swallowed (rumination). The peculiarity of both is its early onset—at once after the meal is eaten, say the patients—and the food tastes as when swallowed, not sour or bitter, as later in the digestion when stenosis of the pylorus is present. As the cardia is innervated by a branch of the vagus (N. dilator cardiae), an undue stimulation of this nerve leaves the sphincter open. This stimulation of the vagus—vagotonus, as it is called—may be of central, peripheral, or reflex origin, and is found in marked hysteria, neurasthenia, or idiocy. The patient often complains of vomiting, but on closer questioning it is found that only a mouthful is brought up at a time, and no emaciation follows as in persistent vomiting. Another peculiarity is that no nausea accompanies it. Furthermore, it may be voluntary, and some individuals, when discomfort is felt, have the power of voluntarily relieving the stomach by this act. Not long ago a patient informed us that the passage of the stomach tube would not be necessary, as, with a swallow or two of water, she could bring up the test breakfast, which she promptly did in our presence an hour after it was taken, and assured us that she often did this for relief. Further examination, including a radiogram, showed that she had a chronic gastric ulcer. In other cases under our observation no change in the gastric contents was observed, though a flow around the tube, when withdrawing them, clinched the diagnosis.

Treatment.—The treatment is very unsatisfactory, but something may be accomplished by intraventricular faradization, and one case was cured by forbidding the patient to remain alone and, in the presence of another, shame prevented her from committing the act, which was semivoluntary.

Insufficient or relaxed pylorus, another symptom dignified to a disease, is largely based on the evidence of inability to inflate the stomach by air or the effervescent mixture, as well as the presence of bile and pancreatic juice in the gastric contents after the stomach has been washed out and the test breakfast given, for the duodenal secretions evidently come through the pylorus freely during fasting. The cause is usually an old ulcer scar at the pylorus preventing complete closure, but not sufficiently extensive to produce stenosis. The nervous variety

has never come under our observation, and some skepticism is permissible as to its existence.

The treatment is wholly futile, and, as no discomfort or harm is caused by it, unless a supposed diarrhea, which is more often due to a concomitant achylia, its management is that of the accompanying ulcer or absent gastric juice.

SENSORY DISTURBANCES.

Sensory disturbances of the stomach may be either purely neuroses or a symptom accompanying other gastric diseases.

Bulimia.—Bulimia, so-called, is a desire for food, imperative and beyond the needs of the organism. It may be well regarded as an exaggerated sense of hunger, and is accompanied by the most unpleasant sense of discomfort unless food can be promptly obtained. A small quantity, such as a glass of milk or a couple of crackers, are often sufficient to stay this hunger. Attacks often come on in the middle of the night, and sleep is sought in vain until the food is obtained.

Symptoms.—The symptoms are both local and general. The former consists of a feeling of emptiness in the epigastrium, that may increase to actual pain. The latter consists of headache, roaring in the ears, vertigo, trembling, and actual fainting may occur; the face may be pale and the extremities cold. Such a condition is not constant, but comes in paroxysms, sometimes being the outcome of nervous excitation, while these attacks, when intermittent, are usually associated with neurasthenia. When the condition is persistent, it is a symptom of some general disease like diabetes, general paralysis, early dementia, and Basedow's disease, or of a localized disease like gastric hypersecretion or ulcer, tapeworm, diarrheas, and gastric ectasia. An access just before death in chronic disease is a popular belief among the laity, and one instance has come under our observation where a man dying of cardiorenal disease, enormously edematous, demanded and obtained from his attendants a hearty meal two hours before his death.

Treatment.—The treatment must be devoted, first, to the control of the underlying cause, and, second, to dulling the sensation at the time of the paroxysm. If associated with hypersecretion or ulcer, the dietary and medicinal treatment of these diseases suggest themselves. If with neurasthenia, the most common accompaniment, the bromides in gram doses hold it in control until hydrotherapy, electricity, massage, etc., can be employed. When attacks occur at night, a supposi-

tory of extractum belladonnae and extractum opii ââ 0.030 gram ($\frac{1}{2}$ grain) inserted at bedtime will often ward off an attack. Closely allied with this condition is the lack of sense of gratification of hunger, as many say, "I rise from the table as hungry as I sat down." This peculiarity, too, may be associated with some disease like diabetes or obesity, or may be one of the manifestations of neurasthenia. In the latter case, in spite of the enormous quantities of food taken, containing far more calories than the weight of the individual demands, the patient is always thin and apparently undernourished. As freaks these individuals often appear in museums, and are reported in newspapers as indulging in strange wagers, where innumerable eggs, oysters, pies, etc., are eaten without apparent injury and with the statement that the appetite was still unappeased.

Nervous Anorexia.—Nervous anorexia is characterized by an utter distaste for food, whose sight and odor often arouse nausea. The influence of appetite on the gastric secretion has already been mentioned, and we are all aware how quickly disappointment, grief, or sudden fright will take away appetite temporarily, and, if food be taken at that time, what discomfort follows its digestion. The anorexia, however, of which we speak now is chronic, and, in spite of its existence, the patients, as far as can be learned from gastric analyses, have a perfect digestion. Our first effort must be to exclude any organic disease like gastric achylia or cancer and gastritis, which have often appeared to us to be particularly provocative of distaste for food. Early pulmonary tuberculosis is also noted for this peculiarity, and the struggle to induce many of these sufferers to participate in the newer treatment of hypernutrition is common to all physicians. As a purely functional disorder, it is most frequent among young girls, and, unless they eat surreptitiously, it is astonishing sometimes to note with what a small quantity of food they can keep their weight and general air of well-being. This condition is popularly supposed to be associated with love, requited or unrequited, so that among the laity, whose observations are worthy of some credence, exultation or depression are equally provocative. From mental abstraction men, bent on some discovery or putting through a "deal," as it is called, often suffer from a form of anorexia, and will state that, without being reminded, they would never think of eating and cannot state whether they have eaten or not. As Lasègue has expressed it, the victim of gastric disease without appetite is distressed that he cannot eat, while to one suffering from nervous anorexia it is a matter of utter indifference whether he eats or not. Naturally, the outcome of this distaste for food is, after a time,

diminished secretion of gastric juice and an uncomfortable period of digestion, which to the young girl is a still stronger argument in favor of going without food. Fatal cases have never come under our observation, but Bouveret reports several from pure inanition.

Treatment.—The treatment is both dietetic and rational. If no organic disease can be discovered, the patient, who will often partake of highly seasoned articles, should always have, as an introduction to a meal, a cup of bouillon, a caviar sandwich, or an anchovy salad for the desire for such articles is often very marked. These preliminary courses should be in small quantity and tastily arranged, when often other articles of food will be taken afterward with relish. If these means are not sufficient, the patient should be removed from the family circle and placed in a sanitarium, where food should be brought at regular intervals in the most attractive form, always garnished with parsley or cherries. In addition to the diet, the hydrotherapeutic, massage, and electricity facilities of the sanitarium will be called on sometimes in vain to effect a cure. Very often the introduction of food by the tube, or even a declaration of intention to perform this act, will induce the patient to attempt to eat. Sometimes this will often remove the fear of strangling, which some patients have from the presence of the globus hystericus. The usual bitters, orexin, nux vomica, and condurango may be employed, but one need not expect much from their use.

Nausea.—Nausea is common enough as a symptom of actual gastric disease, but there is also a nausea of purely nervous origin, which may be a part of hysteria or neurasthenia, or exist as the sole symptom. Many times it comes on only at the sight of food, but may occur at other periods, as in the early morning or during the night. The feeling may arouse a few ineffectual attempts at vomiting, or may continue until a little mucus and bile are evacuated when the attack is over. This nervous nausea is most common among women, and is due to some mechanical displacement of the uterus or to early pregnancy. One of the most obstinate cases in our experience was that of a young surgeon, in whom no other anomaly could be found than an absence of hydrochloric acid from the gastric contents, and both conditions were undoubtedly of nervous origin.

Treatment.—The treatment consists of improving the nutrition of the patient, and, when the attack comes on early in the morning, it is best for the sufferer to take breakfast in bed and then allow a short time to elapse before attempting to rise. This advice works equally well in those prone to seasickness, and our personal experience is that

the most trying hours of a stormy voyage are those from rising time to breakfast. Validol and anesthesin have both served us in keeping this curious anomaly in check.

Nervous Cardialgia.—Nervous cardialgia, or gastralgie, is a term still in common use to describe paroxysmal attacks of pain, sudden in their occurrence, beginning in the epigastrium and radiating to the right or left along the costal borders to the back. Sometimes it is propagated along the sternum, and is described as a burning pain, though no increase of hydrochloric acid or pyrosis exists. These attacks differ from those of cardiospasm, which is a more chronic affair, in that, when a tube is introduced in the latter, it meets with temporary obstruction that is soon overcome. The gastralgie, however, should not be taken for a functional disease until the most careful search has failed to find an organic source for the attacks, and many deny the existence of the purely nervous form of gastralgie. Cohnheim, among these, gives the following causes for these attacks of stomach cramps, and thinks that all instances may be brought under these groups:

1. Diseases of the stomach itself (ulcer, spasm of the pylorus, hypersecretion, perigastritis, and carcinoma).
2. Diseases of neighboring organs (cholelithiasis, pancreatic colic, angina pectoris, and hernia linæ albæ).
3. Diseases of the central nervous system (tabes dorsalis—gastric crises—myelitis, and cerebral tumor).
4. Intoxications (malaria and misuse of tobacco).
5. Reflex disturbances from the genitourinary organs (abnormalities of menstruation, the climacteric, retroflexion of the uterus, and hypertrophied prostate).

On physical examination we often find the victims to be excitable, badly nourished, with gastrophtosis, pulsating sensitive abdominal aortas, with a tender celiac plexus, and often the whole of the epigastrium is hypersensitive. It is rare that one of these various stigmata cannot be found to account for the periodic attacks of pain, and it is only after the most careful examination that we should content ourselves with the diagnosis of nervous gastralgie. Anemia and chlorosis, particularly in girls at or before puberty, are unquestioned causes of these stomach cramps, the attacks lasting from twenty to forty minutes. Between the spasms no discomfort is experienced, and examination of the gastric contents shows usually nothing abnormal. Such cases improve much more on the use of iron than on the various anti-spasmodics and means employed toward improving the digestion, which is in itself a proof of the hematic origin of the illness. The small epi-

gastric hernias are also undoubtedly provocative of these attacks of pain, and, when present, should be either reduced and held in position or removed surgically, as such means have caused the attacks of pain to cease. Attention has already been called to the arteriosclerosis of the abdominal arteries as a cause for pain, often mistaken for gastralgia, occurring at night, without reference to food, and more often after a strenuous day. There may be an associated meteorism and irregular movements of the bowels, an increased blood pressure, and evidences of sclerosis in the superficial arteries, or the secondary involvement of the heart (hypertrophy) usually establishes the diagnosis.

Treatment.—The treatment seeks to accomplish two purposes—relieve the attack of pain and prevent its reoccurrence. The first purpose can be best accomplished by a hypodermic of morphine sulphate, employing 0.015 gram ($\frac{1}{4}$ grain) and watching results. If no relief is obtained, a second injection of an equal amount should follow in ten to twenty minutes. Morphine should never be given the patient to take by the mouth, for, if the attacks are common, as they are apt to be, the morphine habit is soon acquired. Chloroform, as chloroform water, in tablespoonful doses or 2-5 drops of the former on ice pellets, codeine sulphate in 0.03-gram ($\frac{1}{2}$ -grain) doses, and cocaine hydrochloride in similar doses have been used by us per oram, frequently during an attack to avoid the use of morphine, but it is usually in vain, and one must have recourse to the hypodermic. To prevent the recurrence, we must treat the underlying condition. If cholecystitis, the gallbladder must be drained, for, while many recover spontaneously, it is only after a long and tedious illness, with much discomfort and the constant danger of morphinism; if from anemia, iron in the form of ferrum oxidum saccharatum in doses of 0.3 gram (5 grains) several times daily should be employed, or Fowler's solution, well diluted, often acts like a charm, accompanied by appropriate diet; if dependent on tabes, chromium sulphate in doses of 0.25-0.5 gram (4-8 grains) will sometimes aid, but these cases, all must acknowledge, are the most hopeless as regards treatment; if due to abdominal arteriosclerosis, diuretin in 1.0-gram (15-grain) doses two to three times daily, or sajodin in doses of 0.5 gram (8 grains), will soon relieve the symptoms; if resulting from an epigastric (fatty) hernia, the application of some adhesive plaster, with a well-covered button or coin underneath and over the protrusion, will often relieve it. Uterine malpositions, partial atresia of the cervical canal, etc., should be referred at once to a gynecologist, whose correction of the abnormality will often check immediately any

further attacks of gastric pain. Then, there remain the numerous purely neurasthenics, who only after a long employment of every facility in the way of dietetic and hygienic treatment—commonly known as the “building-up” process—can be helped, and then often to a very limited extent. They form the class who wander from physician to physician without relief, finally eschew doctors and take to Christian science.

PART III
SPECIAL INTESTINAL DISEASES

CHAPTER XV

FUNCTIONAL DISTURBANCES OF INTESTINAL DIGESTION (INTESTINAL INDIGESTION)

This term implies any departure from the normal functions of the intestinal canal, but in such a sense it can represent not only a disease, but a symptom, for any pathologic change in the canal—be it inflammatory, a stenosis, or a new growth—must of necessity produce one or more changes in its secretory, motile, absorptive, or excretive functions. Still, there are many functional diseases which are not dependent on any anatomical change in the gut, but on anomalies in the secretion of other organs—the gastric juice, bile, and pancreatic juice. Therefore, while the deprivation of the intestine of the whole or a part of these powerful digestive aids, leading to secondary inflammatory changes and actual anatomical modifications, may produce the same effects, yet the symptoms so overshadow any anatomical changes which can be found that we may look on them as an entity in disease. Many times we have instances, especially in children, where the most careful examination does not allow us to make any other diagnosis than intestinal indigestion, though we are well aware that we are taking the shadow for the object which we cannot discern. Hence the use of the terms nervous diarrhea and intestinal indigestion has remained the prerogative of physicians, though few have any idea of their nature beyond the fact that they represent frequent movements without mucus and general discomfort below the belt line.

ACUTE INTESTINAL INDIGESTION.

Acute intestinal indigestion is not an uncommon condition, characterized by thin, watery discharges containing neither mucus, blood, nor pus; in fact, those abnormal factors which indicate a true inflammatory change. The duration is so short, and so seldom is it dangerous to life, that we have never been able to discover whether any pathologic change underlies it. The examination of the feces, which alone can give us any information of the abnormality of the tract, simply in-

dicates that there must be an enormous transudation into the intestine. Even this is not always demonstrable, for the stool may be only mushy, and then our simple evidence is the presence of numerous food fragments and their decomposed products (gases from carbohydrates, etc.). Clinically, these attacks evince themselves—after the ingestion of certain articles of food or drink, which, unassailable in purity (milk, strawberries, etc.), affect individual patients unfavorably as an idiosyncrasy, or such as are partially decomposed, or at least not strictly fresh—in colicky abdominal pains, frequent stools, and rectal tenesmus. After a short period of abdominal discomfort, often accompanied by loud gurgling noises, the patient must seek the water-closet, where, after the passage of a solid or semisolid stool, relief is temporarily obtained, but the same cycle is soon repeated, and now come frequent fluid dejections, with much gas. According to the severity of the attack, this may cease on the first day or may continue into the next before the stool again becomes normal. Apart from a sense of abdominal discomfort and the initial colicky pains, the condition of the patient is not changed. His appetite remains the same, though he, wise from previous experience, frequently chooses tea and toast or flour gruel until the attack is over. This is sometimes accompanied or preceded by nausea and vomiting—a typical “summer complaint,” as it is often termed—and the food vomited is usually that which has been eaten six to eight hours before, a true sign of the sympathetic or initial involvement of the stomach. In this case the tongue is coated, the appetite fails, there is a bad odor of the breath, and there may be eructations. When, as often happens, the vomiting occurs first, several hours may elapse after it ceases before the diarrhea begins. The physician is rarely summoned until after the illness has lasted some time, and then the examination of feces offers but little light, but observing patients often declare that the discharges were dark, with a putrid odor, or light-colored, sour smelling, and frothy. An earlier inspection by the physician would probably show that they do not differ from those of chronic intestinal indigestion and possess the characteristics of marked protein putrefaction or carbohydrate fermentation. In fact, it comes to the attention of every physician that the chronic form is always preceded by one or more attacks of this acute variety, the last of which progresses to the persistent form.

Treatment.—The treatment consists of an initial purge by castor oil or calomel if there have not been numerous discharges, and then the use of a bland diet of milk, gruel, broth, toast, and gelatine. Also the following mixture will be found beneficial:

R. Bismuthi subgallatis 6.0 or 1½ drams
Misturæ cretæ 100.0 or 3 ounces
M. Sig.: Teaspoonful every three hours. Shake well.

CHRONIC GASTROGENOUS INTESTINAL INDIGESTION.

Chronic gastrogenous intestinal indigestion has become pretty well recognized by its recurrent type, in which intervals of comparative well-being are interspersed when the stools are normal in consistency and number, or the diarrhea may be constant. Furthermore, an investigation of the gastric functions usually shows a deficiency of gastric juice, particularly of hydrochloric acid, even if a complete achylia does not exist. This constant relation between the disturbed gastric and intestinal digestion has further been proven by the fact that, with a largely meat-free diet and the medicinal use of hydrochloric acid, the diarrhea can be kept under control. Nor need it be always the secretory function of the stomach which is disturbed, for impairment of gastric motility may also be a causative factor in the maintenance of the diarrhea. So far has A. Schmidt carried this observation that the presence in the stool of large quantities of connective tissue would be regarded by him as proof positive of a failing secretion and motility of the stomach. Our own observations, published in an article previously mentioned (page 164), would not allow us to go as far as that, but, when this peculiarity of the stool is found, gastric examination rarely fails to show lacking stomach functions. The explanation of this diarrhea has been offered in the loss of the bactericide action of hydrochloric acid, which has long ago been refuted by the author and others, in the impairment of the amount of pancreatic juice, which almost invariably accompanies it, and in the increasing residue of meat fibers in the intestine, an admirable culture medium for putrefactive bacteria, due to the failure of digestion of the connective tissue which incloses the fiber and fat, and hence restrains them from the action of the pancreatic juice.

Symptoms.—The symptoms usually begin with those pertaining to the stomach—loss of appetite, nausea, pressure after eating, and eructations—but, when the unpleasant abdominal symptoms begin, the former have ceased, or, because of the greater prominence of the latter, are forgotten. The stools diminish in consistency and increase in frequency; in fact, form what is commonly known as diarrhea, which either accompanies the gastric symptoms or follows them after a very short interval. The first attack may be stayed and recurrent ones appear until the disease is chronic, or the first one may persist without

any relief. Sometimes, indeed, the initial gastric symptoms have entirely disappeared, and the patient does not come to the physician until the diarrhea has become unendurable, being frequently of five to ten years' duration. Sometimes this diarrhea may be the outcome of a typhoid fever, and perhaps more often the result of an infantile intestinal catarrh. Almost always the disease, when first observed, is chronic, as evinced by the absence of colicky pains and the presence of malnutrition. Still, after long duration we may observe a moderate loss of flesh, weakness, and anemia, particularly when no long intervals have intervened between the attacks of diarrhea. Very often patients complain that certain articles of diet like ice cream, game, or ice water bring on an attack, or that sudden cooling of the body, as in marked change in temperature, riding in an open car when heated, etc., is the cause. They describe themselves as the victim of a "weakness" of the bowels as they would a tendency to colds or rheumatism. Nor need this frequency be a typical diarrhea distributed over the day. Many are aroused in the early morning, have one, two, or more loose movements, and then are not troubled for the day, or some have to leave every meal, or only dinner, for stool and then can finish the day in comfort. Periods, too, of confined bowels may intervene, but eventually the diarrhea always returns. The disagreeable odor of the stool is always described, and, while no actual pain may be present, there is usually more or less distention of the abdomen and unpleasant rumbling of the intestines. The appetite remains excellent, and this alone often leads the patients to excesses. While the general condition may not be impaired, it is usual to find the sufferers with thin abdominal walls and a peculiar paleness, dependent on the frequent reduction of the hemoglobin to 75 per cent and the number of the erythrocytes diminishes to 3.5 millions. The gastric analysis usually shows the acidity not above 10 and the free hydrochloric acid absent. E. Schuetz has frequently found the motility impaired even with the presence of hydrochloric acid. The stools are noted for being "mushy," or even liquid, but no mucus can be found. On a self-chosen diet the patient passes many fragments of undigested vegetable matter (remnants of celery, lettuce, pea hulls, etc.) and connective tissue visible to the naked eye. On the Schmidt diet these often disappear, and diarrhea, too, may cease, or there may be only two soft stools daily. Again, on the test diet the diarrhea may increase, which is probably due to the large quantity of milk taken.

Microscopically, such a stool will show many a muscle fiber with sharp edges and well colored, together with starch granules inside the

potato cells, as well as the latter without the granules; neutral fats and fatty acids are usually wanting, as, on the whole, fat is well digested and absorbed.

The question naturally arises how many achylies, or those suffering from an acidity, have this intestinal indigestion. E. Schuetz, taking statistics from reports of all authors, declares that 30 per cent suffer from temporary or persistent diarrhea. A noticeable factor in the characteristic of the stool is the absence of mucus, for, while in the gastric contents its presence is not of so great import, in the stool it means a catarrh, and here it divides the purely functional intestinal indigestion from that with inflammatory changes. The persistent presence of meat fibers and starch in the feces points also to a lacking action of the pancreatic juice; not necessarily an insufficient amount of the juice, but, on account of the short stay of the food in the duodenum, due to the increased peristalsis, the food fragments are less assailable to the pancreatic ferments. Efforts actually made to determine whether the pancreatic juice was really diminished, as estimated by the relative weakness of the action of trypsin in these diarrheas, have never given positive results either one way or the other. The facts to be emphasized in this disease are, largely, that it is confined to the small intestine, is not catarrhal or inflammatory, and damages chiefly the digestion and absorption, now of protein, now of starch, and often of both.

Treatment.—The treatment of this condition is preeminently a dietetic one, and, on account of the primary failure of the stomach to attack the envelope, the connective tissue of meat and the pectins, the basis of the vegetable structure, so that the meat fiber and starch may be subjective to the digestive action of the ferments of the pancreas, the most minute division of the food is absolutely necessary. When, on account of imperfect teeth or the habit of hasty eating, this cannot be accomplished by natural means, we must obtain the same results by artificial aids. All meats must be finely chopped or ground and vegetables mashed, to which must be added, of course, thorough cooking. As the deficiency of gastric digestion is the exciting cause, all those precautions given under gastric achylia and hypochlorhydria must be observed, and, above all, care must be taken that large quantities of food are not taken at a time. When meat fibers or starch predominate in the stools, we may restrict the one or the other, but, on the whole, the patient should receive a mixed diet, with the ingredients in the usual proportion. Equally suggestive of the need of restriction of the protein or carbohydrates is the putrid odor and

marked alkaline reaction, or the sour odor and strong acid reaction. It is sometimes surprising how the abstention from meat or vegetables, in either case, will cause the frequent passages to be limited to one or two daily. Gelatine as a substitute for albuminous articles of food is strongly recommended because it is easily digested in the duodenum, and does not induce putrefactive products as does albumin. Then, again, by the substitution of a larger proportion of carbohydrates we may diminish the growth of putrefactive bacteria in the intestine, and, by excess of protein, the fermentative group. Sugar, toast, and dextrinized flour also form the most advisable varieties of carbohydrates for short periods because so readily absorbed. In fact, the diet for testing intestinal functions (page 167), modified in this way, forms the best basis for their substitution, with the exception of the milk, which may at first be digested by lactone tablets and then later unmodified milk substituted. The best medicinal means for the control of this intestinal indigestion is dilute hydrochloric acid, in doses suggested under Gastric Diseases, or acidol. Often the first few doses, in conjunction with the change in diet, are sufficient to check the frequent movements. Pankreon will also improve the digestion and absorption of the predominant elements in the stool, starch and meat fibers, and temporarily check the diarrhea. It may be found necessary to employ the tannin preparations (tannalbin, tannigen, etc.) or the bismuth preparations (subcarbonate, subgallate—dermatol—etc.) temporarily, but their use should be confined to the smallest doses and should cease at the earliest possible moment, as by restricting the peristalsis they make the patient more comfortable, but aid putrefaction or fermentation. It has been our experience that, by too energetic treatment, we may produce the other extreme—confined bowels. In this case laxatives must never be employed because they frequently bring back the former condition in an exaggerated form; it is much better to employ enemata, and perhaps give a little petroleum or agar-agar.

INTESTINAL FERMENTATIVE INDIGESTION.

Intestinal fermentative indigestion has an existence as a disease based largely on fecal findings and the readiness with which fermentative changes occur in the stool, either standing in a warm room or in a brood oven. Many a time a stool remaining a few hours in an air-tight jar in our laboratory has developed by fermentation such a volume of gas that, on removing the cover, the greater portion of the contents of the jar have been blown out. A strong acid reaction has also been de-

veloped. Furthermore, if in a stool of this kind, examined fresh, many starch granules are found, all these starch fragments will have vanished after being allowed to stand in an air-tight jar in a warm place. From this it can be readily seen that the basis of this disease is a much impaired utilization of starch and the presence in the intestine of many fermentative organisms. The seat of this failure to utilize starch is in the ileum, and the starch particularly affected is that inclosed in the cellulose, which in the normal individual is digested to a certain extent, but fails utterly of digestion in persons suffering from this disorder. These unabsorbed portions of starch and hemicellulose afford an admirable culture medium for fermentative organisms, which they apparently utilize to the limit. The main distinction between this and the previous abnormality is that here starch alone fails of digestion, while there it may be fat, protein, or starch, or any two; in other words, it is not specific in its failure. Patients declare that they have suffered from it for years and cannot tell exactly when it did begin. Any acute attacks of fermentative diarrhea are not of this variety, but of the first described when the stomach is simultaneously involved. Occasionally we get the history of recurrent attacks and periods of well-being between them. Patients can even state what articles of food bring on an attack, which they religiously avoid, such as uncooked fruit, Graham bread, and potatoes. Again, individuals acquire this form of indigestion on an exclusive vegetable diet, either on their own volition, as a fad, or because it was recommended by a physician on account of a tendency to gout, arteriosclerosis, or renal disease. The stools, which number from two to six during the day, are not necessarily liquid, but semisolid, extremely acid, and "burn" the anus, as patients complain. There is extreme flatulency, both at the time of stool and at other times, and complaint is made of the constant rumbling of the bowels. Colics are not usual, but a temporary spasm of a portion of the intestine may cause extreme distention of the abdomen, so great, in fact, that women must often lay aside their corsets. Usually no complaint is made of the stomach functions; in fact, such patients often boast of their excellent gastric digestion and cannot understand why the lower abdomen should prove so troublesome. The general condition of the patient may remain excellent and the nutrition unimpaired, but fretfulness soon supervenes, sometimes associated with weariness, dizziness, and occasional headaches. Physical examination shows a somewhat distended abdomen, the muscles are moderately contracted, there is considerable tympany in parts, and the gurgling noises are very noticeable. Many a time it has been our lot to examine the gastric contents in

these diarrheas, thinking to find an achylia, and almost as often the results were perfectly normal, so that we can easily differentiate this variety from the gastrogenous.

The feces form the best evidence of the presence of this variety of intestinal indigestion. They are very light-colored, of acid reaction, due to acetic and butyric acids, and, when a small portion is rubbed on a slide, gas bubbles can be seen to escape, and, as a whole, the stool has a frothy appearance. No mucus is found in uncomplicated cases, but, when to a fragment of the stool iodine is added and it is examined under the microscope, an abundance of starch granules can be seen, and, if the patient is on the test diet, these are found largely within the potato cells, though they may be isolated, and some cells may be distinctly seen with their outline stained yellow, but empty. (See Fig. 37.)

Another noticeable feature is the great number of oval microbes, containing granulose, which stain equally blue, and are arranged in chains or groups. In addition, many yellow-stained yeast spores are found and a few long unstained bacilli (lactic acid). The fermentation test shows the excessive evolution of gas, a markedly increased acid reaction of the fluid, and the disappearance of a large part of the starch granules when examined under a microscope. The search with the naked eye for starch fragments may be worth while, but our experience is that it is largely futile, and one smear under the microscope will give more information than an hour's observation with the unaided eye. Hydrobilirubin is present in the feces in normal quantities and never bilirubin, unless the constant irritation of these fermentative acids has produced a catarrh, when bilirubin and mucus may be present. These attacks of catarrh are common, and during them it is difficult to trace the condition to a fermentative indigestion, since the mucus, meat, and fatty acids form a feature of the slide, but the inflammatory state may be overcome when the patient returns, not to health, but to the former fermentative diarrhea on the least provocation.

The chief points in diagnosis are the character of the stool—not particularly the absence of mucus, meat fibers, connective tissue, and fat, but the predominance of starch and the lack of participation on the part of the stomach.

The prognosis is unfavorable in that one cannot be restored to such a state that all vegetables can be freely indulged in. Much like diabetes, there is a cellulose limit established in such individuals beyond

which they dare not go. Long moderate restriction, however, increases this tolerance to such an extent that a marked increase may be indulged in without harm, but probably the period never returns when restrictions are not necessary.

Treatment.—The treatment of this form of intestinal indigestion often demands only a regulation of the diet for complete restoration to temporary normal conditions. As the starch is the source of the disorder, it is possible to exclude this almost wholly from the diet for a few days, and the employment of a strict fat-protein regimen may be instituted, which is not so easily carried out as in diabetes, for we must also exclude salads and green vegetables. We may, however, allow a small quantity of sugar, either cane or milk, to replace the loss of other food, since these sugars, on account of their rapid absorption, leave no residue for the culture of the fermentative organisms. The diet list, adapted from A. Schmidt, is as follows:

DIET LIST IN FERMENTATIVE INTESTINAL INDIGESTION.

Breakfast.—Tea or coffee free from caffeine (Café des Invalides), with milk or cream, two soft boiled eggs, two lumps of sugar or a dessertspoonful of fruit jelly.

11 a. m.—Bouillon, with a beaten egg cooked in it, and some minced ham.

Dinner.—Bouillon, fish cooked with butter or tenderloin steak; gelatine, with a little sugar and cream.

4 p. m.—Bouillon and chopped ham.

Supper.—Cold chicken or turkey, omelet, and tea.

According to our experience, after two days of this diet the stool changes its complexion completely; it is found darker, alkaline in reaction, and no longer can one find fermentative organisms in it. If the change does not take place promptly, it is well to continue the diet for two days longer; then the change to the ordinary diet should not take place at once, but more sugar should be added, and honey may be employed, while later the patient may have toast or zwieback. Here, too, finely ground, toasted bread, or croutons, makes an excellent addition, without the danger of recurring diarrhea. The thick soups made with oatmeal or flour may be next added and also well-cooked rice. Potatoes should be the last thing given, and then only as purée; they are particularly liable to cause a return of the indigestion, and, if possible, patients should be induced to go without them. Pankreon and bismuth subsalicylate may be employed if the diet does not check the

discharges, for fermentative growths can be controlled much more readily than putrefactive. A favorite prescription of ours for this condition is as follows:

R. Mentholis,
Resorcinolis, aa 2.0 or $\frac{1}{2}$ dram
Bismuthi subsalicylatis 6.0 or $1\frac{1}{2}$ drams
M. Fac in capsulas XX.
Sig.: One every four hours.

After the attack is over, the quantity of vegetables must be restricted to only one vegetable at a meal, excluding by preference potatoes, beets, radishes, and turnips.

HABITUAL FUNCTIONAL CONSTIPATION.

Habitual functional constipation is perhaps quite the most common complaint to which we have to listen, either in a clinic, frequented by the poor, or among our well-to-do patients. It is sometimes looked on as increasing in frequency, but, when we consider the "Lady Webster" and other famous cathartic pills, dating from the seventeenth century, we will realize that this condition is not an innovation. We must clearly understand what the patient means when he says he is constipated. He may imply infrequent movements—that is, one in two or three days; that a daily movement is usually hard—"hard as stone" say the poorer patients; or he may mean a scanty movement, with a sense of insufficient defecation. Prolapsed or an unusually long colon was long thought to be a cause of infrequent movements, but the x-ray has taught us that this does not always follow, nor are there lacking those whose investigations seem to prove that sometimes the displacements of the colon are due to its primary overloading with fecal matter; this is particularly true, according to some, of the cecum mobile and dilated sigmoid flexure. Weakness of the adjuvant defecating muscles, especially in women who have borne children, such as diastasis of the recti or paresis of the abdominal muscles as a whole, as well as a spasm of the sphincter, are accused, but the instances are legion where no such cause is found, nor can any obstruction whatever be detected which will account for this faulty defecation. Fleiner thought he had added to our knowledge some new light when he divided constipation into two classes—an atonic, dependent on lack of muscular tone of the colon; the other spastic, due to contractions of the ring muscles at different points, but not always at the same point at all times in the same individual, which produces as well colicky pains, rumbling noises, dis-

tention of those portions of the tract above the contraction, and physically a well-defined cord representing the contracted portion of the canal. Boas, however, basing his opinion on the newer palpation technic, rectoscopy, and examination of the stool, has declared that no evidences of this condition (spasmodic contraction) are clearly enough defined to enable it to be characterized as a disease, and, furthermore, that these same observations can be made at times in those suffering from an atonic colon—indeed, in those whose defecation is normal. There is no doubt that spasmodic contractions do occur in the colon, which delay the passage of feces and rarely cause symptoms of ileus, but these are brought about by locally diseased portions, and are to be compared to the cramps of the sphincter from anal fissure and dysenteric patches in the rectum. These states, however, have nothing to do with habitual constipation, a condition not accompanied usually by any pain, spasm, or other local discomfort. In the stomach and esophagus we speak of weakened musculature, but in the colon, with its powerful muscles, we must look for some other cause, and that is faulty nerve innervation or overstimulation of the prohibitory nerves. Many examples of this we see in true spasm, due to local disease, in lead poisoning, in tabes and myelitis, in carbon dioxide poison from hepatic or cardiac stasis, and in neurasthenia, but outside of the last, which may equally as well be the result of constipation as a cause, the others are so rare, compared with the enormous distribution of the disorder, that, while we look for them, we rarely find them. Atrophy of the colon musculature has been offered as a cause, but, since experimentally the colon has been freed from its muscles in animals and the feces were not at all delayed in their course, this has become untenable, a conclusion which is still further substantiated by the fact that, no matter how obstinate or long continued the constipation is, stools can usually be produced by laxatives, which would establish the fact that the muscles are unimpaired and will respond to an exaggerated stimulus. Thus we are driven to the old statement of Nothnagel, "that the nervous innervation of the colon and rectum is abnormal," and, as the coroner's jury used to render the verdict in regard to an undiscovered murderer, "perpetrator unknown," we may also say, "cause of faulty innervation unknown." Physiologically, the gases and volatile acids, formed from cellulose by bacteria and other unabsorbable residue of the food, act as inciters of peristalsis, so that A. Schmidt asks why may not the loss of these factors account for the lacking peristalsis, and he proceeds to answer this question by demonstrating that the constipated possess an abnormal digestive and absorptive power, particularly for cellulose.

There seems to be much in this contention. The bacteria are much less in number in the feces, there is an alkaline reaction, indol and skatol are not increased either in the stool or urine, and no fermentative or putrefactive products are found after the brood oven test. On account of this, vastly less residue is contained in the feces of the constipated, not only of nitrogenous matter, but also of cellulose. Curiously enough, when the constipated are given food containing cellulose—like coarse bread, radishes, asparagus, etc.—there is not a corresponding increase in the fecal residue as in the normal individual, nor is the peristalsis approximately increased. This is not only a laboratory experience (Lohrisch), but also a clinical observation. For instance, the first meal in a vegetarian restaurant will often cause two or three movements in those with normal colon innervation, but will produce no effect on the constipated.

Symptoms.—The symptoms of functional constipation are varied, or may be entirely absent. It is a generally accepted notion among the laity that a stool should occur daily, and, when this fails, individuals, though possessed of good digestion and appetite, become restless and are much disturbed mentally over this impaired function. Then, again, the fear, ungrounded though it may be, of acute obstruction, is ever present with the patient and recourse is had to laxatives, which, as all know, increase the difficulty until the greater effort necessary to secure a daily movement brings him to the physician. Then, another group does have actual discomfort in this condition; there is a dull sensation in the head, increasing at times to an ache, and dizziness often follows; rush of blood to the head, inability to concentrate one's mind on mental work, and a feeling of distention in the lower abdomen are complained of. These are the symptoms which are so often ascribed to autointoxication, with which they probably have nothing to do. Others complain of purely local difficulty—a moderate tenesmus, unrelieved by the scanty stool which often follows; vague painful sensations, particularly over the cecum, often interpreted by the patient as appendicitis, and sometimes at the flexures of the colon, exaggerated by deep inspiration, and always demanding an examination of the lower pleura, though no increased respiration is present; gurgling is heard in the abdomen, and true colic may sometimes occur ("spastic form"). Then, too, hemorrhoids often accompany constipation, which may be of the bleeding variety, or are occasionally inflamed. The patient's description of the difficulty of defecation is as varied as his other symptoms. Some declare that the feces are packed above the anus, but cannot be forced out. Others complain

that, in spite of daily stools, they know that a large part of the fecal matter is retained and that the abdomen is gradually filling up. Still others claim that they go to stool many times daily, but only a few fragments are discharged, without any relief of their desire; then occasionally, without laxatives, there comes an enormous stool, made up of feces, blood stained or with mucus adherent, accompanied by some pain, a form of the atonic constipation. At other times, associated with sphincter cramp, there is a stool of lead pencil or ribbon shape form, or it may be made up of small round fragments like marbles. Such persons, after the constant use of laxatives, have semi-solid or even fluid stools, showing that there is no organic obstruction, or the form would be maintained even after cathartics. Often, on close examination, these bizarre forms of stool are found not to be unusually dry or hard, but assume this appearance from spasm of the lowest portion of the tract.

Physical examination throws but little light on the condition. The individual may be thin or obese; the abdomen may be soft and flat or moderately distended; there may be areas of tympany, particularly over the cecum and ascending colon, while these parts may be slightly tender to pressure or entirely without sensitiveness; often the contracted portion of the colon can be rolled under the finger, and, when relaxed, the gush of contents can be felt to pass through it. Rarely can fecal masses be felt in the descending colon and sigmoid, and those, according to our observation, only in enteroptotic women with thin abdominal walls.

To diet has been ascribed much of the constipation of today, and, while it is less common on a mixed, well-proportioned ration, still the sailors, whose deprivation of vegetables and fruit has, at least in past days, been a subject of remark, have never been particularly subject to it. Many incidental causes of this disturbed nerve innervation of the colon can be removed, such as the neglect of the desire for defecation, so common from motives of inconvenience or lack of time, the abuse of laxatives, which appear to many as the "easiest way" rather than a recourse to change of diet; further, the indifference of both patient and, sad to relate, often of the physician to relaxed abdominal walls after confinement. There are also many minor moments which often start the train of symptoms—an ocean voyage, with its excessive eating and little exercise, an early train which one must catch immediately after breakfast, the usual time among many for the stool, etc. The commonest cause of the so-called spastic form is an acute catarrh of the colon, accompanied by diarrhea, which is followed by a

compensatory cessation from stool, and from this a chronic condition arises. Then, often it is the result of a pure reflex from an adhesion after an appendectomy or an operation on the genital organs, or the irritation may be more local—hemorrhoids and fissure; in many instances an atonic condition of the colon was followed by the spastic. It has often occurred to those that make numerous examinations of gastric contents that the stomach is not always above reproach for this disorder, either producing an excess of gastric juice or holding back the fluid on account of a narrowed pylorus or impaired muscular tone. Which is primary, the constipation or the hypersecretion, authorities cannot decide. A. Schmidt's view is that, in pursuance of his theory of overactive digestion of cellulose, the superefficient gastric juice dissolves the inclosing pectin substances, and hence encourages greater absorption, less residue, and constipation. When patients complain about the lower abdomen in constipation, their complaints are usually much the same—fullness and pressure—though every objective sign is wanting; there is no meteorism, no excessive discharge of flatus or objective tenderness to pressure; in other words, the symptoms are largely those of neurasthenia. In fact, a strong diagnostic point in favor of the functional character of the disease is this great disparity between the voluble complaints of the patient and this absence of objective signs. True meteorism really begins only when from stenosis or peritonitis there is an obstruction in the circulation in the vessels of the abdominal organs, and this is never found in functional constipation. It happens rarely in very thin-walled women that one can see a portion of the intestine become rigid (spastic form), but even then, with a rumbling sound, it soon disappears, only to appear at another point. This, as can be seen, differs very decidedly from the true stenosis, which is fixed. With these borborygmi come all gradations of abdominal discomfort, from a slight ache to actual colicky pains, and the favorite sites for these are at the hepatic and splenic flexures, where spasm of the colon seems most common; in fact, one can often follow up a distended tympanitic colon from the cecum to the right costal border, only to lose it under the liver, and at the next visit of the patient to the clinic it has vanished. When it is thought that one feels scybala in the sigmoid, the patient should be sent home for a good dose of castor oil and told to return in a couple of days, when it often turns out that only the contracted portion of that part of the colon was felt.

The x-ray examination of the constipated shows no delay until the bismuth residue enters the cecum, so that after twenty-four hours

none or very little has reached the transverse colon. From these pictures it would seem as if the process of thickening, undergone by the feces at the middle of the transverse portion in normal individuals, began here in the constipated.



Fig. 79.—Radiogram of marked looping of colon, accompanied by constipation. (Collection of Dr. Atrial W. George.)

The second form is found in cases of marked looping of the colon, and here the delay is not so much in the cecum as distributed equally throughout the whole colon. Here it is distinctly seen that the colon

gives an equally intense shadow throughout its course; in other words, the stasis is not confined to the ascending colon.

One should never neglect the introduction of the well-guarded finger into the rectum of every patient complaining of constipation, for often



Fig. 81.—Radiogram of rectum packed with feces. (Collection of Dr. Arad W. George.)

a spasm of the sphincter will be found, dependent on hemorrhoids and fissure, and the rectum packed with feces. This is not constipation, but local obstruction, and can be treated only by removal of the cause: on the contrary, when true functional constipation exists, the rectum is usually found empty.

The stools of those constipated, when examined, show a vast variety of gross forms. First, we have the double conical type of diminished length, which may not be unnaturally hard, but is often smeared with blood; this is undoubtedly found with spasmodic contraction of the anal sphincter. Then there is the only partially formed stool, whose cylindrical shape is lost by the separation of its individual parts when passed, small scybala, which are not especially hard, but very tenacious, and disintegrate with difficulty; these are said to be associated with the spastic period. Then, last, we have the hard form, dry balls, which are often faceted like gallstones and are discharged singly; these, according to A. Schmidt, accompany the atonic state of the colon. These balls of feces are, as a rule, covered with shreds of mucus and often blood stained; this mucus is clearly the effect of the irritation of the fecal masses and not primary. When, on the contrary, small shreds of mucus are discharged unmixed with fecal matter, the constipation is secondary, and there is a so-called mucous colitis.

As far as the nervous symptoms associated with constipation are concerned, to which attention has already been called, it is very doubtful if the abnormal defecation has anything to do with them, but forms only a coordinated symptom of the general neurasthenic condition. As a proof of this conclusion, we may call attention to the fact that, if the movements be regulated by diet and laxatives, some of the manifestations, like fullness in the head or dizziness, will be avoided, but fugitive pains and insomnia take their place in the complaints of the patient.

As some of the results of continued constipation, we may mention hemorrhoids, which undoubtedly may be caused by the long stay of these hardened masses in the lower rectum and the overfilling of the veins during the straining at stool. True enteroliths, large masses which increase gradually from a small scybalum by successive layers of fecal matter, much like a school boy's snow ball which is rolled over the soft snow, are occasionally found as a result of constipation, but, according to our observation, only in elderly people, where they often arouse a suspicion of a malignant growth. They frequently lose the quality of plasticity by which they recede before the examining finger, the best means we have for their detection, and, by producing secondary inflammatory disturbances in the mucous membrane or even ulcer, and, as Virchow found, localized peritoneal invasion and adhesions, thus become painful on pressure. They are usually situated in the rectum or sigmoid, and in a case under our observation one was

found in the transverse colon. They are dangerous, largely because they sometimes acquire the size of a child's head, and may cause total obstruction or perforation of the intestinal wall and general peritonitis.

Extensive colon catarrh very rarely arises from chronic constipation, though, when a spastic condition of the intestine intervenes, mucus may be more abundant and the condition differentiated from a mucous colitis with great difficulty. All of us have seen instances of painful inflammatory disturbances in the cecal region, often accompanied by rise in temperature, and relieved in a day or two by a mild laxative. This condition, formerly known as typhlitis stercoralis, was supposed to be due to the fecal accumulation in this portion of the colon, but, as the contents here must, with a very few exceptions, be liquid, it can hardly be possible that any irritation may arise, such as is found in the sigmoid with the enteroliths. It would seem much more probable that undue fermentation or putrefaction must be the exciting cause. At least the contention of some surgeons that the appendix is always involved is untenable, for spasm of the rectus has never been seen by us, and the appearance and general condition of the patient are always indicative of a much less violent disturbance than an inflamed appendix. Colic and fever are two conditions which arise from these hardened masses of feces in the intestine. The former may cause the most excruciating pain, accompanied by collapse and meteorism, demanding one or two injections of morphine, and ceasing only after two or three free movements of the bowels. The latter is less strongly substantiated and may be coincident, yet rises of temperature occur, with no other condition than that of constipation, and disappear on free catharsis.

Accumulations of fecal matter, too, may cause the presence of nucleoalbumin and mucous casts (cylindroids) in the urine, and, while no one attempts to associate nephritis with constipation in a causal relation, still a pyelitis may be aroused by the colon bacillus, whose growth and migration through the lymph vessels to the urinary tract are encouraged by stagnation of intestinal contents.

The heart symptoms associated with constipation are mild precordial distress (much commoner after mealtime than after exercise), palpitation, and intermission. It is very improbable that coprostasia is an instrumental agent in producing these symptoms, but both are the outcome of the patient's neurasthenic condition, or the cardiac irregularities (providing the heart is muscularly insufficient) may be due to accumulations of gas in the splenic flexure. Similar conditions

pertain in bronchial asthma and epilepsy, while there is no substantiation for the belief that chlorosis springs from constipation. The diagnosis comprises three points:

1. To determine whether the patient actually is constipated, for many declare themselves constipated when they consider the stool insufficient and themselves unrelieved by defecation, while an inspection of the stool shows its adequacy.

2. We must learn by digital examination whether there is actual constipation or whether the rectum remains filled with fecal matter from sphincter cramp arising from fissure or hemorrhoids, or the much rarer rectal cancer.

3. Whether we are dealing with a functional disorder or there is an actual organic obstruction at some point in the tract, brought about by bands, kinks, twists, adhesions, or the graver evil—a malignant growth.

This differentiation will, in the early stages of true obstruction, try all our means of examination to the breaking point, not excluding röntgenology, and then often leave us somewhat undecided.

Treatment.—The treatment often requires the utmost ingenuity of the physician. First, to break up the habit of the free use of laxatives, whose use always appeals to the laity because the temporary results are certain, and it is much less burdensome to swallow your pill at bedtime than to observe rules of diet, cold baths, etc.; hence many physicians, when the constipated apply, simply change the laxative. But after the underlying conditions of the constipated have been studied, gastric hypersecretion or stasis, neurasthenia, and the special state of the colon noted (spasm or atony), and the anal sphincter investigated (spasm with full rectum), then vigorous measures must be adopted to remedy the special form found, consisting of dietary, physical, and medicinal measures, the use of enemata, and possibly an operation.

Diet.—The diet, based on physiologic standpoints, must consist of coarse foods containing much cellulose (like Graham, brown, and rye bread), all the breakfast foods (particularly oatmeal), green vegetables (like lettuce, green pease, cucumbers, pickles, and cabbage), and all fruits and berries. These substances all act by producing a voluminous stool, but we have others which have a stimulating effect on peristalsis, such as milk sugar, buttermilk, cider, and honey, while salted articles (like salt codfish, mackerel, and finnanhaddie) have the same effect. On the other hand, certain articles of food, like cocoa, rice, macaroni, and cheese, have the opposite effect of retarding per-

istalsis, and should be avoided. When there is a spastic condition of the colon, with painful sensations, colicky attacks, and much flatulency, some authorities would eliminate the coarser articles, like cabbage, radishes, beet greens, and celery, while others would persist in a consistent anticonstipation diet containing these foods, even if mucous colitis were present. These varieties of food, arranged in a diet list, would read as follows:

DIET LIST IN CONSTIPATION.

On rising.—A glass of cold water, with a tablespoonful of milk sugar or a pinch of salt.

Breakfast.—Fruit (grapefruit, cantaloupe, oranges, or apples), covered with cream and sugar, Graham or rye bread (toasted if desired), with one or two pats of butter.

11 a. m..—A glass of buttermilk, with a tablespoonful of milk sugar, or some fruit.

Dinner.—Clear soup; meat or fish, with gravy; spinach, cauliflower, Brussels sprouts, beet greens, or celery; a salad; cooked or canned fruit, with cream; a glass of Rhine wine or cider.

4 p. m..—A rye bread-and-butter sandwich, thickly spread with jelly or honey.

Supper.—Salt herring or codfish and cream or anchovy salad, cold cornbeef or hash of the same; Graham bread or toast, with butter; olives, a salad, coffee or a glass of malt.

Bedtime.—A glass of water, with a tablespoonful of milk sugar.

It sometimes happens that with this large volume of food, containing so much cellulose, the patient at first complains of colicky pains, and then careful examination will show a spastic condition of the colon. Under such circumstances a preliminary diet containing the same articles of food, with the exclusion of the coarse bread and salads, may be necessary, when a gradual return to the full diet may be made without discomfort. Then, again, even in those in whom the atonic state of the colon is present, this coarse diet may fail to produce any effect on the frequency or consistence of the stools, either because, having already been tried by the patient, the fermentative acids and gases have no effect on the jaded intestine, or on account of the persistent use of laxatives, but perhaps more commonly because these people, as A. Schmidt maintains, can digest cellulose so well that little residue remains. Under such circumstances, articles must be added to the food which are known to be indigestible and which leave the intestine as they enter the mouth. One of such articles is agar-agar,

which can be procured at any drug store, cooked in vegetables or fruit, and eaten without any distaste. The quantity is dependent on the results; with some a few strands suffice, others must use a great deal to produce any result. The regulin, which A. Schmidt has fathered, is expensive, and has no value beyond crude agar-agar, apart from the cascara sagrada which has been added, and which patients can take during the early part of the treatment in the form of the extract at bedtime, in steadily decreasing doses, while the agar-agar is being pushed. Purified petroleum is another substance which escapes digestion and absorption, and can be used in tablespoonful doses in almost unlimited quantities until a laxative effect is produced. Copious water drinking is also desirable, particularly where excess of perspiration or urine (diabetes) is a contributing factor, though, physiologically, excess of water has not been found to change the consistency of the stools, yet in diarrheas ice water will very often cause a movement immediately after being taken, long before it could be absorbed. The attempts to change the bacterial growth in the intestine by the use of cultures of lactic acid bacilli have not been very successful; still, the persistent drinking of buttermilk or yoghurt, not fermented more than one day, may cause the desired transformation. We hear at times of certain individuals who have accomplished a cure by the ingestion of sea sand, but this has never secured the approbation of the profession.

Physical Treatment.—The physical treatment includes, as its most important feature, massage, which can be employed in all cases, even in the most spastic forms, with benefit to the patient. The only instances where one must refrain are those of more or less recent appendicitis or peritoneal inflammation. The patient will often complain, during the first session, of pain, but this is very apt to be due to the sensitive abdominal muscles. If, however, a markedly localized spot of tenderness is found, not discovered during the physical examination, no harm will be done by light massage at first, gradually increasing to the point of toleration. The methods are described under *Massage* (page 240), and every physician should at first carry out a few treatments himself before turning his patient over to a trained masseur. Vibration massage is much less effective than manual, but has the added advantage that it may be carried out at home. It is useless to attempt this form of treatment unless the patient will consent to six weeks of its employment, and then it should be continued at short intervals for a year, with pauses between, which add efficacy to its results, not gained if the process is continuous without pauses.

Faradization for periods of five to ten minutes, with a current as strong as the patient will stand, can also be employed, either with both electrodes on the abdomen or one in the rectum, and is particularly effective in neurasthenic patients with sphincter spasm and a constantly filled rectum. Since an unpleasant experience with a galvanic current, which caused superficial burns, its employment by us has been given up. Exercises and gymnastics prove beneficial when there is weakness in the abdominal muscles, rowing in a boat or a rowing machine, or the wall weights, being best adapted. Change of position from prone to sitting without aid of the hands, or the legs raised upon the trunk, also aid. The neurasthenic variety, on the contrary, is not benefited to any extent by violent exercise, and after months of efforts of this sort, much to one's chagrin, when a patient is put to bed for a rest diet treatment, stools often occur after a time with regularity, and the physician queries his judgment in not employing this method sooner. Cold and hot water play their part in the treatment. When there is a spastic condition and painful sensations, a hot hip bath at bedtime soothes and relaxes the spasm and enables the patient to sleep, while the cold spray applied to the abdomen on rising will sometimes relieve the most obstinate chronic variety. No one claims that any of these modes of treatment increase the intestinal peristalsis, but they do improve and strengthen the abdominal muscles, which are always called in play in difficult defecation. As has been observed, these muscles can also be employed with much greater force if the patient assumes the squatting position without any support for the buttocks. Our experience does not extend to the stripping process for removing feces from the rectum, but in any event it could be of aid only when the rectum was well filled.

Laxatives have long been avoided by the more intelligent physicians in the treatment of constipation, because they rarely cure, but one pill begets another, and so the intestine demands its bribe before it will consent to work. Still, there are times when a mild laxative is necessary as an adjunct to dietetic and other treatment, but such a one should be of the least violent character, like cascara or phenolphthalein, which, taken at bedtime, can be gradually reduced in amount, or periods of one or two days allowed to intervene between doses. Our advice usually is, if no stool occurs in the morning, that the patient take a dose at night; this insures one day's freedom from their use, and often the nights on which no pill is taken will be followed by mornings when stool occurs, provided the other means are being employed. The other group of laxatives—the salines, sodium phos-

phate, and artificial Carlsbad salts, etc.—are employed when catarrhal conditions are present, or suspected to cause the constipation, and prove their worth by a return to natural movements after a period of their use. In the ordinary atonic form, however, they are worse than useless, for the instant they are dropped, the patient is as bad or worse off than before. For the most aggravated cases a course of water drinking at French Lick, Saratoga, or Bedford Springs, for those who can afford it, is desirable, but, as said, only when catarrhal conditions—or, as the laity often have it, “liver trouble”—are present. Very often when continuous use of a laxative is demanded, one can get along with a small piece of rhubarb root, which is carried in the pocket, and a fragment bitten off and eaten two or three times daily. None of these agencies, as far as our observation extends, produces griping, and the only objection to their use is their ineffectiveness upon those who have abused cathartics for a long time. For the last class something more active is needed, and castor oil may be used at rare intervals to remove fecal masses and then recourse be had to the milder preparations, but continued use of the oil, even in small doses, undoubtedly produces a catarrhal condition of the intestine from its irritation. The enormous variety of laxatives which grace our Pharmacopeia has sprung from the desire to change the medicine frequently, lest the patient become accustomed to any one kind, which is supposed after a time to lose its activity on the same individual. Strange to say, however, we are told many times by patients that they have used a small amount of cascara or rhubarb for years, never increasing the dose, and from its use have daily movements. In such a case the employment of another kind is entirely futile. Then, we have those instances where the spastic form predominates and a sedative is demanded. No better one can be found than extractum belladonnæ in suppositories of 0.02 gram ($\frac{1}{3}$ grain), one of which is to be inserted nightly until such time as free movement occurs—often an astonishingly short time if the form is purely spastic. As it is sometimes difficult to determine exactly whether the atonic or spastic form predominates, a combination of cascara and belladonna, like the following, has served us very well:

R Extracti belladonnæ 0.2 or 3 grains
Extracti rhamni purshianæ 6.0 or $1\frac{1}{2}$ drams
Fiat massa et divide in pilulas XX.
Sig.: One or two at bedtime.

These pills can be used for weeks without the slightest danger from harm. Hormonal, a substance isolated from the spleen of animals

killed in a state of active digestion, has been used for chronic constipation with fair results, according to Glitsch. One intragluteal injection of 20 c.c. was usually sufficient to cause daily movements for three months in some and less in others, but the effects were vastly reinforced by a second injection, without harmful results. Still, its use is not wholly without dangers, and chills, fever, and ominously increased blood pressure have been reported from its employment. At best, its future use will be confined to relieving the bowels after operations or in acute fecal obstructions.

The use of enemata has a limited field in treatment, but is not the universal panacea which it is supposed to be, and, above all, such quantities of water as are advised to be given with the "internal bath" arrangement still advertised in some of our best magazines are positively dangerous. When the rectum is packed with feces, as determined by a digital examination, a cupful of water with soap and glycerine is sufficient, but may have to be repeated. When the accumulation is higher up, a pint usually suffices if allowed to enter slowly and is retained, as Boas suggests, over night. If the treatment is to be continued any length of time, only salt should be added, for the other ingredients commonly employed—soap, glycerine, etc.—may produce too much irritation and a catarrh develop from a purely functional condition. The spastic form of constipation is totally unfitted for treatment by enema, for the introduction of the fluid is accompanied by pain and an irresistible tenesmus, by which the liquid is forced out; in fact, this is a diagnostic point in this state—inability of the patient's lower colon to retain injected fluid. Following the suggestion of Singer-Glaesner, much use has been made by us of cholic acid as an ingredient of the enemata, mixed with sodium bicarbonate to aid solution. The proportion is as follows:

R Colalin	3.0 or 45 grains
Sodii bicarbonatis	40.0 or 1½ drams
M. Divide in chartulas X.	

Sig.: One added to a pint of water for injection.

The same can also be used in 0.5-gram suppositories, though not as effective as by injection. Such application of the cholic acid produces prompt contractions of the colon, as is shown by the radiogram, and stool often follows in twenty to thirty minutes. In a clinic sought by many hundreds of constipated women, most of whom have borne a dozen children, this treatment has given satisfaction. The oil injections of Fleiner have a limited field, and are not a cure-all, as was supposed. Its employment is unquestionably confined to the spastic

variety of constipation with painful sensations. It does not always soften the hardened masses of feces, and many times patients report its discharge the next morning unchanged. Furthermore, it has been known, after a long use, to set up irritation by its split fatty acids, one of the features that makes it a stimulant to the colon.

Regulation of habits is of the greatest importance as an adjuvant to the cure of constipation. There should always be in every one's schedule for the day a regular time for stool, and at this period an effort should always be made for its accomplishment. A natural call should never be deferred because, curiously enough, it is not apt to be repeated until the next day; force of habit in regard to time of defecation is an unquestioned one and cannot be explained. Furthermore, we should endeavor to remove the obsession of certain patients that all feelings of discomfort, like fullness of the head and inability to apply one's self mentally, come from the absence of a movement on that particular day. In this respect a temporary injunction to forget all about the act has been of aid, especially to those who employ mental treatment. As this condition of constipation has existed in many since childhood, no effort should be spared to induce also the child to have a regular time for stool. This is not the duty particularly of the physician, but that of the parent or teacher, who should be advised to pursue this course.

Special conditions accompanying constipation demand appropriate treatment. For instance, colics, whether due to habitual constipation or, as often happens, to lead poisoning, must first be allayed by a hypodermic of morphine sulphate and then the intestine cleaned out by the vigorous use of castor oil; then, if the patient is subjected to the dangers of lead poisoning, magnesium sulphate or a weak sulphuric acid lemonade should be used frequently to prevent a recurrence of the attacks of pain. "Stoppage" by fecal concrements in the aged is fairly common, and, while producing none of the symptoms which so ordinarily accompany kinks or twists of the intestine, may become very ominous on account of the age and feebleness of the patient. A hypodermic injection of 1 mgm. of atropine sulphate and repeated enemata of soap and water are often necessary to remove the obstacle.

Operative intervention should always be preceded by an x-ray examination, because, sad to say, we cannot always depend on other clinical tests. The operative procedures have been discussed in general in the chapter on Treatment, but attention is called here to a few of the conditions which demand the surgeon's aid. Hirsch-

sprung's disease, or congenitally dilated colon, manifests itself largely, of course, by the exaggerated constipation, and so far has never been relieved by mechanical or medicinal means. The implantation of the ileum in the sigmoid by Lane has given only partial relief, and later he suggested and carried out, in conjunction with this operation, the removal of the cecum and half of the transverse colon. Our experience has been limited to one case, and here, much to our surprise, the expected loose movements did not occur, and, other than the fact that the constipation was overcome, the patient underwent no detriment in nutrition or general conditions. Wilm's modifications, by which the ileum is implanted in the transverse colon and then the cecum and the remainder of the colon adjacent closed off by mattress sutures, has proved equally efficacious and much less dangerous. The suspension and fixation of the cecum where typhlatony (the result of a large accumulation of feces in the cecum) was present, has proved very satisfactory where the constipation is caused by this anomaly. It must be emphasized that there is no universal treatment for all forms of constipation. Every patient must be first examined carefully to determine with which peculiar form—sphincter spasm, spastic or atonic colon, or adhesions—he is afflicted, and then the treatment for this particular form applied.

PARASITIC INTESTINAL INDIGESTION.

Parasitic intestinal indigestion is much less common among the better classes of people than in the clinics. Even there, where a large number of patients are treated, careful examination of the feces wherever abnormal symptoms are present will show that, on account of the strict inspection of food by governmental agencies, parasites, particularly tapeworm, are vastly less common. Rarely in a service of three months will more than two or three cases of actual parasites be discovered.

Tapeworms.—Tapeworms may or may not cause symptoms. Very often the first thing which attracts the attention of the patient is the discharge of segments or fragments. Nervous individuals, however, are often largely distressed by these discharges, and a train of symptoms are aroused which are largely subjective. There is loss of appetite, nausea, desire for uncommon articles—like chalk, earth, etc.—eructations, and a peculiar bitter taste in the mouth are described; creeping sensations in the abdomen are complained of, which are much worse after highly seasoned food or sour articles are eaten; constipa-

tion or diarrhea may be present, or may alternate, with the passage of much mucus. It is often possible that here a confusion with mucous colitis takes place—headache, confusion of thought, giddiness, and even fainting attacks may occur. Emaciation is sometimes present, in spite of abundant food, and there may be unequal pupils and intermittent rises of temperature, as well as mild tetany. These symptoms are ascribed to local irritation as well as to reflex irritation or poisoning from substances evolved by the parasite. The latter possibility has been thoroughly investigated by Talquist, who found in the members of the *bothriocephalus latus* group a substance which possessed strong hemolytic power; and, in truth, the broad tapeworm produces a severe and sometimes fatal anemia, which has all of the histological earmarks of the malignant pernicious variety. The other varieties of tapeworm rarely produce excessive anemia. Many of the nervous complaints are purely neurasthenic, for patients who have not a sign of a worm, but rather mucous colitis, whose broad, flattened bands of mucus closely resemble the worm, have the same symptoms. The diagnosis should never be allowed to rest on the statement of the patient or his symptoms, but the fragments must be found and identified before treatment is applied. This can sometimes be accomplished in a busy clinic by washing out the colon with a copious, so-called high injection, applied fractionally; rarely, if fragments are present, will they fail to be washed out. The detection of Charcot-Leyden crystals and eosinophiles, either in the stool or the increase of the latter in the blood, cannot be utilized for positive diagnosis.

The expulsion of the tapeworm can be best accomplished by making the patient fast on the day before the destruction of the parasite is attempted, during which one or two doses of a laxative (sodium phosphate or magnesium sulphate) are taken. On the morning of the effort the patient is to remain in bed, and take *oleoresina aspidii*, 8 grams (2 drams) in four doses in capsules at half-hour intervals, and black coffee if nausea is produced; one hour after the last dose, if the worm is not expelled, a good dose of Epsom or Glauber's salts is taken. The patient must be asked to save with great care the discharges after the treatment, put them through cheesecloth, wash them well with water, and transfer to a fruit jar, to be brought to the clinic, for, unless after a careful examination the head is discovered, the whole process will have to be gone through later, as the presumption always is that the head has not been removed. One's success is largely dependent on the quality of the preparation of aspidium, for one does not dare to take chances with a much increased dose in expectation

that the preparation is old, for, if fresh and the regular dose is employed, it may sometimes cause decided poisonous symptoms. Pelletierine tannate, 0.3 gram (5 grains) in capsule, and filmaron—or, better, filmaron oil—a 10 per cent solution of the active principle of aspidium in castor oil, put up conveniently in 5-gram capsules (0.5 gram filmaron), two of which are to be taken at half-hour intervals, followed two hours later by a full dose of castor oil, are very good substitutes for the crude drug, but are equally dangerous in large doses, and their cost is prohibitive in a clinic.

Round Worms.—Round worms are, of course, most common in children, and cause the mothers much distress, since all the ailments of childhood are attributed to their malign influence, as were all diseases formerly in Hahnemann's mind attributable to scabies. Still, as mentioned, they have been found by us in the stomach of a young man at autopsy, where they often migrate, and are either vomited or make their way to the glottis, producing choking symptoms, or escape from the nose or mouth. In the intestine they have been known to form a ball, which was perceptible through the abdominal wall as a small tumor. Much oftener, however, they may make their way to the common hepatic duct, which they may close completely.

Symptoms.—The symptoms which they cause are described as nausea, distaste for food, pain in the abdomen, constipation or diarrhea, accompanied by discharge of mucus, twitching of the muscles, grinding of the teeth, outeries at night (to the mother the most suggestive feature), emaciation, and actual convulsions. Of course, we must bear in mind that all these symptoms may occur in children without any evidence of worms, and twice in our experience an emetic after a convulsion has brought to light, in children under 2 years of age, in one case bologna sausage and in the other fried potatoes instead of the expected worms. Here, too, a secondary action of the secretion of the worms may be responsible for the nervous symptoms. As these worms are often passed per anum, the diagnosis of their actual presence in the intestine is not difficult, and in their absence the examination of the stools will show the presence of the easily recognized eggs.

Their removal is usually accomplished by santonin given in 0.03-gram ($\frac{1}{4}$ grain) doses after meals for two or three days, followed by a laxative, either calomel or magnesium sulphate, which can be dissolved in birch beer for children on account of its unpleasant taste. Castor oil should never be employed because the drug is readily soluble in it, and may produce poisonous effects, or the santonin and the calomel may

be combined, as in the following prescription from the Manual of the Pharmacopeia (A.M.A.):

R Santonini,
Hydrargyri chloridi mitis, $\frac{1}{2}$0.5 or 8 grains
Sacchari lactis1.0 or 15 grains
M. Divide in chartulas X.
Sig.: One after meals three times daily.

Oxyuris vermicularis, or threadworm, is the most harmless of the group, and annoys chiefly by causing itching of the anus and neighboring parts. At operation for appendicitis a mass of them is often found in this appendage, and here they probably grow to wander into the whole colon. That they are sometimes an exciting cause of the inflamed appendix must be conceded, but the event must be uncommon, comparing the frequency of the presence of the threadworm with the rarity of appendicitis. It is practically useless to attempt to drive out these pests by medicine given by mouth, but high injections of vinegar and water or a tablespoonful of fluid extract of quassia to a pint of water, injected several nights in succession, and preceded by a soap and water injection if the lower bowel is filled with fecal matter, are usually effective.

The *necator Americanus*, or hookworm, a branch of the *ankylostoma duodenale* family, has caused much interest in our country because of the intense anemia which it causes when once well established in the duodenum. It enters the body of man, not only through the mouth, but through the unbroken skin, and from the carelessness of the poorer dwellers of the South with regard to outhouses, or rather the lack of them, and the custom of many of these people to go barefooted, their distribution was well spread until the governmental health forces and the philanthropy of the Rockefeller fund began to check their growth. Dr. Stiles' lectures and pictures before the laity and his traveling clinics, held through the region most affected, are a tower of strength for the eradication of the hookworm. After the infection and previous to the appearance of the marked anemia, some time may elapse, during which the symptoms are chiefly loss of appetite, nausea, heartburn, and vomiting, together with either constipation or diarrhea. The abdominal symptoms become much more distinctive with the increasing pallor, the abdomen is more distended, and here and there points can be found which are tender to pressure. The liquid stools contain much food residue, mucus, and blood. Eosinophile leucocytes are found commonly with the feces, and eosinophilia of the blood is much more marked than with any other parasite. The blood in the feces is

not only due to the inflammatory disturbance, but comes from the wounds of the intestine produced by the bites of the hookworm. The anemia which accompanies the presence of these parasites in the intestine is secondary, but with an occasional change to the most malignant, pernicious type. While it is the poorer classes of the South that propagate these hookworm infections, many others may become hosts, for, during our teaching at the University of Texas, students were often found who harbored these pests. The eggs are easily recognized, even when the worms are not found.

Treatment.—The treatment, which was introduced by the Government through the infected regions, was the use of 2-4 grams ($\frac{1}{2}$ -1 dram) of thymol, given in four doses in capsules during the day, and followed by a tablespoonful of magnesium sulphate in water; in other words, for a few cents many a one has been freed from his enemy, while the action of the Government, reinforced by private aid, has been to arouse the exposed individual from his indifference to this disease.

INTESTINAL INDIGESTION IN BASEDOW'S DISEASE.

Intestinal indigestion in Basedow's disease has come to the attention of every one who has had occasion to treat this peculiar pathologic condition. It is also associated with Addison's disease, which one meets with vastly less often. In uremia and sepsis, as well as in other infectious diseases—pneumonia, malaria, measles, etc.—there is marked diarrhea, due, as is supposed, to the irritation of the intestinal mucous membrane by toxic substances reaching it through the blood. There exists marked transudation, but very little change in the mucous surface of the bowel. Mucus and food fragments are also rare in the stool. With Basedow's disease the diarrhea is different. Though it may be aroused by the irritation of a secretion of the overactive thyroid, there are many food remnants in the stool, which indicate clearly that an intestinal indigestion, in the sense which we employ, exists. The diarrheas of Basedow's disease (those of Addison's have never come to our attention) are periodic, as if at times the gland reached the acme of its output of the deleterious secretion. They are very virulent, lasting for days or a week, and very difficult to control. The most characteristic feature of the stool, in many cases, is the fat, which usually comprises 33-77 per cent of that taken as food, but usually in well-split form, so that no impairment of the pancreas can be demonstrated. The stools number from two to ten daily, and many fatty acid needles are found, but no meat fibers, even if the amount of the latter taken

by mouth is very much increased, nor does mucus form any considerable constituent of the feces. In a case for a long time under our observation, whose stool was examined frequently, there was no predominance of fat and no other changes than one would expect from a hurried peristalsis—a moderate amount of all the food ingredients and no mucus. Still, A. Schmidt would have us believe that in some way the pancreas is affected because there is often associated an alimentary glycosuria.

Treatment.—The treatment is also as unsatisfactory as the etiology of the disease. When fatty stools occur, neither restriction of this constituent of food nor pankreon makes any change in the amount excreted. Falta found that the x-ray treatment applied to the thyroid caused both the glycosuria and the fatty diarrhea to cease. Eppinger and Von Noorden, Jr., employed rectal injections of adrenalin, using 30 drops of the 1:1,000 solution in 300 c.c. of water, on the theory that the increased peristalsis was due to exaggerated vagotonus, and obtained excellent results. As these attacks of diarrhea are periodic and self-limited, one should not put too much dependence on any mode of treatment other than the removal of the thyroid or means to check its increased secretion.

INTESTINAL INDIGESTION FROM DEGENERATION.

Intestinal indigestion as a result of degeneration of the mesenteric glands and amyloid disease of the mucous membrane are both accompanied by great distention of the abdomen, while the patient emaciates rapidly. The stools in these cases are mushy and not watery, light-yellow in color, and rich in fat, of which at least 20-30 per cent are lost. The feces are acid in reaction, and contain, apart from the fat, very few muscle fibers and no starch. As the fat is usually well split, the failure is one of absorption, and is of minor importance compared with the greater one of tuberculosis of the glands involved, but is a severe hindrance to the proper nourishment of the victim. Amyloid disease springs readily from other intestinal disease, particularly tuberculosis, and produces excessive watery stools, with all varieties of food remnants, many of them visible to the naked eye, and with a marked tendency to putrefaction. Again, one may observe instances of marked impairment of fat absorption and many muscle fibers, whether due to a coincident disease of the pancreas or to increased motility cannot be told. The enlarged amyloid liver often accompanies this intestinal condition and should always be sought under the right costal border, if it cannot be readily seen as it frequently can.

NERVOUS DIARRHEA.

Nervous diarrhea is characterized by the absolute failure of any objective cause and its occurrence on any occasion which overexcites the patient. Of course, there is an increased peristalsis, but whether the stimulus is reflex or passes directly from the brain cannot be told. Various causes have been given for its occurrence—motility and secretion neuroses—but the truth apparently is that both processes are involved. The most readily recognized clinical type of this disease is diarrhea which arises from anxiety. Young surgeons performing their first operation, students just before a severe examination, and the Arabian Nights tell many a tale of fright as its cause, so that it must have been a well-recognized difficulty in earlier days. There are two or three loose movements, perhaps with some tenesmus, and then things go as before. In those who from childhood up have had this weakness it takes but little to arouse an attack. A former patient of ours, of the old régime, could never receive a telegram without this effect, because it might contain bad news and she would hesitate to open it, and she could not remember a time in her life when violent emotions, particularly worry, did not produce the same result. In a coaching trip through Scotland and Ireland a lady of the party would almost invariably hold up the vehicle a few minutes after it was ready to start while she sought a lavatory, because another could not be reached easily during the period of the trip, reminding me of Nothnagel's patient, who began to feel an intense desire for stool as soon as he found he was far from a water closet. Indeed, this intense nervous tenesmus is usually the cause of the diarrhea. There are also those who are readily affected by being chilled without actually acquiring a coryza or bronchitis, and respond with frequent movements, while at other times the stool is perfectly normal, so that, to avoid this, such persons wear a warm abdominal band as a preventive. There may also occur a copious discharge of weakly alkaline fluid at times, usually arousing a patient from sleep, without a vestige of fecal matter, much like the so-called "water brash" of the stomach and esophagus, which is probably almost wholly intestinal transudate.

The most characteristic feature of these diarrheas is the suddenness with which they occur. The patient is feeling perfectly well, when perhaps, with some rumbling in the abdomen and possibly discomfort in the same region, but no pain, there is a tenesmus, a passage of some gas, and then the watery stools, when the affair is over, much like a thunderstorm, and the patient may be free for weeks or months. All

efforts to discover an article of food which caused the attack is in vain. It occurs after eating at the best hotels as readily as after a meal at a night lunch counter. With some a headache of the unilateral variety may precede, and Moebius thinks it often replaces the persistent vomiting in migraine. No disturbance of health other than this is noted—the patient has a good appetite and eats what he pleases without the slightest tendency to produce an attack.

The feces in all cases of this character, chiefly those of more or less duration, where it has been our opportunity to examine them have had the ordinary food remnants—fats, muscle fibers, and starch—in equal proportions, and but little in excess of what are usually found in health; there has been no mucus. Of course, in the very acute attacks, which are over after three or four movements, the feces have never been examined, and we are all equally ignorant as to their character. Presumably because of the copiousness of the stools, the whole tract must be emptied and the feces contain abundant gross and microscopic food remnants. Whether we are dealing actually with a nervous diarrhea can be told only by examination of the stools in the intervals, when a catarrhal condition will be readily recognized, or, if the attacks occur, as they sometimes do, daily at certain periods (early morning hours, after dinner, etc.), the absence of mucus or any marked presence of food fragments, or predominance of one over the other, will identify it as the nervous form.

Treatment.—The treatment is extremely unsatisfactory because the disease, unlike other intestinal disorders, is entirely, according to our observation, uninfluenced by diet. A hot sitz-bath before going to bed will aid when the call comes at 3 or 4 A. M., and a glass of claret or a cup of strong tea at bedtime may avail. Medicines are of little value, though validol or anesthesin will sometimes check the oversusceptibility. In obstinate cases a cupful of starch clyster, with 20 drops of *tinctura opii*, at bedtime, will hold the bowels quiet until morning, but opiates must never be given by mouth for fear of the habit. When the attack comes on during dinner, in the presence of the family or guests, at regular intervals, if the patient eat alone in his room, it will often break up the sequence. A complete change of scene will sometimes check the habit, one is almost inclined to say, because it follows no laws of disease, and the Great White Way of New York, with champagne and ices, long forbidden, effected a cure in one of our most obstinate cases.

CHAPTER XVI

INFLAMMATORY DISEASES OF THE INTESTINE

As with the stomach, we differentiate carefully between mere impaired functions of the intestine and impaired functions dependent on anatomical changes. For instance, we may have a diarrhea, as we have seen, without any discernible anatomical cause, or we may have one dependent on a tubercular or dysenteric ulcer. Hence it is perfectly useless to say that a patient is suffering from diarrhea. Stagnation of blood in the abdominal organs also leads to impaired function as well as to actual inflammatory disease, but it would not be correct to call all intestinal indigestions associated with cardiac leakage or hepatic obstruction "stasis catarrhs" when no inflammation was present. Then, too, we must try to separate the symptoms due to intestinal catarrh, as it is called, from nervous ones. This word catarrh makes an excellent designation for a condition where the superficial epithelial layer is affected, with hyperemia of the blood vessels, whereby an excessive secretion of mucus takes place. It does not cover the term enteritis, of which it is only a part, as the latter includes inflammation also of submucous and interstitial tissue. It has also been demonstrated where any considerable amount of mucus is found in the stool that true enteritis (with the exception of mucous colitis) exists which has passed beyond the mucous layer. Another point which causes great difficulty is the determination of the site of the inflammation. When confined to the cecum, appendix, sigmoid, and rectum, physical signs will usually fix its site, but elsewhere, from the stool alone, our only means of its establishment, it is a difficult matter, in spite of Nothnagel's efforts to establish some rules for our aid. As a rule, from fecal examination we may learn that the inflammatory process is confined to the large or small intestine, but farther we may not go. As far as cause is concerned, it is well to divide, as has always been done, these catarrhs into the primary and secondary. The former includes those arising *per se* and the latter those which are the outcome of some other disease, like tuberculosis, dysentery, carcinoma, stenosis, or typhoid. This separation is also of great value clinically, because we must apply our therapeutic efforts

to the primary disease rather than to the catarrh. Again, it is rare that the catarrh originated where it is found. When in the small intestine, it is apt to come from the stomach, or, rather, its imperfectly digested food may arouse it; and when in the colon, it has often been aroused by putrefaction or fermentation of food which should have been digested and absorbed in the small intestine.

GASTROENTERITIS.

Gastroenteritis, or gastroenterocolitis, is a term which includes an inflammation of the entire digestive tract, a condition which we sometimes find. Its cause, while considered by the laity as some article of food or drink, is more often infectious or toxic. Of the former we have the infections peculiar to the tract—that of the colon bacillus, of the paratyphoid and the ameba—or the infection may be general, with only a participation on the part of the tract, like influenza, pneumonia, and sepsis. These attacks are much more common in summer than in winter, but whether the conditions are favorable for a more vigorous growth of bacteria in the food at this season, or whether the digestive juices of the patient are less effective in destroying those germs entering the tract, cannot be told. A large number of chemical substances also may excite a catarrh, such as lead, mercury, and copper in workmen in these metals, or excessive use of alcohol, tobacco, or condiments. Medicaments, too—salvarsan, mercury, and sodium cacodylate—used hypodermatically or intravenously, may be eliminated into the canal and cause catarrhs. These inflammations are also aroused by nephritis, uremia, and extensive burns. Among the rarer causes are a stenosis due to malignant disease, enteroliths or gallstones causing obstruction in the intestine, or what is sometimes known as intestinal sand or gravel.

Symptoms.—The symptoms usually begin in perfect health, and the stomach may or may not be affected. As a rule, one profuse attack of vomiting ends the participation of the stomach, colicky pains intervene, and at first scanty semisolid or solid stools occur, followed shortly by liquid ones, with much gas and tenesmus. The patient feels very ill, becomes pale, and his nose is pinched as in collapse; there may be chills, and the temperature often rises to 100–104 degrees; the movements increase until they number five to fifteen during the day, and, while the thirst is intense from the loss of so much fluid, the patient fears to drink because it increases his pain and number of movements; in a very few days the patient becomes emaciated,

the stools consist largely of water and are odorless, while the urine is almost suppressed; pains in the muscles and cramps in the calves intervene, the temperature sinks, and the pulse become rapid and weak; the skin assumes a marked pallor, except that of the extremities, which may become bluish; cold sweats occur, and still the patient may recover—a fatal termination is rare. Usually, however, the attack is much lighter; the stools diminish after three days; some food may be taken without their increase, and after a considerable period convalescence is established, but great care must be taken for a long time with the diet, or a recurrence of the diarrhea takes place, and after one or two repetitions the disease becomes chronic. Constipation is also liable to follow for a short time, and, as stated, must not be treated with laxatives. The change in the general condition depends largely on the build and constitution of the individual. Weak, undernourished persons are vastly more affected than the stronger, though the violence of the attack may be the same. Some, too, suffer from dyspnea and palpitation of the heart, which has been variously ascribed to the pressure of the diaphragm on the heart and lungs, driven up by the distention of the intestines by gas, while others attribute it to autointoxication.

Cerebral irritations (delirium and convulsions) are chiefly confined to children. The fever has not been so common in our experience, perhaps because the cases which were under our care were not so severe. The abdominal distress is of two kinds—a feeling of fullness and tension, and the repeatedly occurring cramps, during which the patient presses his hands against his abdomen and draws up his knees. As, after a series of these cramps, a stool follows, they are probably due to violent peristalsis and spasm of the intestine. They may occur anywhere in the abdomen, or are more often confined to the left iliac region, and, if the rectum is involved, there is a painful tenesmus after stool and a sense of incomplete defecation. On inspection of the abdomen, no marked distention can be discovered, nor does percussion show that much gas is present. It is only the fact that borborygmi are common and flatus is continually discharging, often with a fragment of feces, that we are assured that gas is present in any amount. During the colicky attacks there is an involuntary retraction of the abdomen, so that it may look quite flat, and at the same time, if the walls are thin and there is a diastasis of the recti, the exaggerated peristalsis of the intestines can be seen. In some portions of the abdomen this is more marked than others, and a tap with the fingers will elicit succussion, showing an accumulation of gas and fluid. Palpa-

tion is usually unpleasant to the patient, if not actually painful; in fact, here and there can be found points whose manipulation causes exquisite pain, if one can judge from the countenance of the patient. Occasionally, too, when the walls are thin, one can discover the contracted colon as a cord, but this spasm is not confined to one part, but changes its position, or, rather, different parts of the colon are thrown into spasm at various times. The examination of the feces is of great importance, not only from a diagnostic point of view, but from a prognostic, because until the stools have returned to the normal in frequency and character (absence of mucus) we dare not pronounce our patient cured and allow him to go back to his indiscriminate diet. From the patient himself we can obtain only the statement that the stools are liquid and ascertain their number daily. In fact, after the first stool they are ejected with great force (in spurts), are of a dirty-brown color, and have a very foul odor. Later the character will change in accordance with the diet. If milk, oatmeal and barley gruels, and carbohydrates (ground toasted bread) are given, they become yellow, have a sour odor and acid reaction, and indicate clearly that fermentative processes are going on in the intestine. It is not unusual during the first few days for the stools to have a golden-yellow color or a tinge of green, because the bile pigment is hurried along without an opportunity for reduction. Often the stools have a jelly-like consistency on account of the large amount of mucus, existing chiefly in masses, from the beginning of the tract (duodenum or jejunum). Later the fermentative character of the stool disappears, it becomes colorless, and has a neutral reaction. During the early period, before the intestine is cleared out, the naked eye will plainly discover fragments of connective tissue, with masses of muscle fiber embedded, which appear as small brown specks, and groups of potato cells. After the patient is on the rigid diet, the microscope will still show starch granules, masses of casein, groups of split fats, and, if broths are used, sharp-angled muscle fibers. From this it can be determined that the inflammation extends even to the duodenum, and that all the ingredients of food are affected, which means that either an exaggerated peristalsis or impaired digestive juices are responsible, but, as diastase and trypsin have both been found in the discharges, the former supposition is probably the true one. Of the real products of inflammation, the mucus is the most important. It may be distributed through the feces, so that they will quiver like a mass of jelly, or it may be in lumps (sago grains), or in shreds that float on top of the liquid stool. The fragments may be glassy, stained yellow, brown,

or green with hydrobilarubin or bilirubin, or red with blood. They are either clear or cloudy from an admixture of detritus from epithelial cells and fats. When mucus is absent, we are not dealing with an enteritis, but with an indigestion. The microscope shows only a scanty display of epithelial cells in the mucus, shriveled, round, with vacuoles and erythrocytes, if from the colon, and only nuclei and abundant bacteria if from the small intestine. Leucocytes are lacking, and erythrocytes are found only in the mucus. While the stomach was always supposed to be involved in these attacks, recent statistics show that in not more than half of the cases do we have vomiting. The stomach, however, is very promptly restored to its normal condition long before the inflammation has left the intestine. The urine is always very scanty, contains a large amount of urobilin and indican, often a trace of albumin, and, what is more significant to the patient, usually deposits a heavy layer of urates. The course of the disease is generally restricted to eight to fourteen days.

ENTEROCOLITIS.

Chronic enterocolitis may arise from an acute attack where the convalescence is long delayed, or after several acute attacks, or sometimes occurs where no acute attack—at least in the memory of the patient—has ever taken place. In the latter case, however, there has been complaint for years of abdominal discomfort, consisting of distention, rumbling of the intestines, and a tendency to looseness of the bowels on any indiscretion of diet, such as the abundant use of potatoes, fruit, milk, or ice cream. It would seem that intestinal indigestion, as described before, exists, with an occasional exacerbation, which approaches the catarrhal stage. These people, too, after a time acquire what may be termed intestinal hypochondriasis, much as the constipated do, and every act of their lives is considered only with reference to its effect on the intestinal condition. There is little or no pain, except perhaps after taking food, which seems to incite peristalsis, and after stool, when there is apparently a temporary colon spasm. The patient's weight and general condition seem to be uninfluenced, unless the small intestine is especially affected, together with pancreatic achylia, so that there is a great loss of nutritive elements (a rare condition), though a peculiar pallor may arise after long continuance of the disease, which reminds one of pernicious anemia. In a careful study of eleven cases of pernicious anemia, which was published by us, no features were found in the stools which could not be

discovered in other intestinal catarrhs where no anemia existed, other than the excessive hydrobilirubin, and, as instances of the former outnumber the latter enormously, there is apparently no causative relation. From the objective examination, one can learn but little. There is never any abdominal resistance, and only occasionally can one feel and hear a gush of intestinal contents through some temporarily contracted portion of the tract. Rarely is the colon sensitive to pressure, but its cordlike contraction is less common than in the acute form.

The excessive number of movements—or, perhaps, it would be better to say the irregularity of the stools—forms the chief complaint of the victim of chronic enterocolitis. When both large and small intestine are equally involved, and we are not dealing with an enteritis or a colitis, they vary from one to many mushy stools daily. Then there may come a period when the stools are normal for a short time, or under the use of astringents, which every doctor prescribes, may become even hard or “constipated,” as the patient describes it, but the mucus still persists. Then succeeds another period, without any known cause, of loose movements. The customary alternation between constipation and diarrhea, as is found in pure colitis, does not occur here. The stools are perfectly painless, unlike the acute form, nor does tenesmus follow. The feces have much the same characteristics as in the acute form, though erythrocytes are much less commonly attached to the mucus, and leucocytes almost never occur. In our experience the digestion and absorption of meat and fat seem to suffer much more than that of starch, and square-cornered muscle fibers and soap and fatty acid needles will be found vastly oftener than the starch granules. Mucus is always present, and its absence excludes, as before stated, a deep-seated inflammatory process. The fragments are often hard to find because so intimately mixed with the feces, but, if several fecal masses be allowed to stand in water over night, the next morning one can fish out specimens free from fecal matter and finely adapted to microscopic examination. This mucus exists in two forms—small fragments, looking moth eaten and containing cell nuclei, and larger and more stable looking patches, which are covered with rolled up epithelial cells, whose nuclei can usually be brought out by staining. Both varieties are colorless, or a dirty-gray, when separated from fecal matter in this way, and it seems assured that the former come from the small intestine, though A. Schmidt speaks of bilirubin coloring as a prerequisite. Usually, on account of the excess of mucus, the feces are dark-brown in color, have a putrid odor, and a strong alkaline reaction.

The duration of the disease can generally be placed as a lifetime, for the victim has usually suffered for years from the diarrhea when he comes to the physician; in fact, few patients know when it did begin. Under the physician's care temporary relief is obtained, and he discharges the patient as cured, only to learn that a colleague is treating him for the same disorder—as a patient once said to us "I wish I could remember the names of the doctors who have cured me of this complaint."

The diagnosis often requires some thought because of the similarity to other abdominal lesions. For instance, the diarrhea of typhoid might prove confusing, but the latter has a longer onset, more continuous fever, rose spots, enlarged spleen, and gives an agglutination test. With appendicitis there may be confusion, but the markedly local tenderness and pain, spasm of the rectus, mass, and higher temperature in the latter, usually protect us. The colicky pains before each discharge and tenesmus after, usually decide in favor of enterocolitis. In the chronic form the question is largely, are we dealing with a disease that involves the whole intestinal tract,—the large or small intestine. The presence of numerous food particles means that the higher portion of the tract is most involved, while washing out the colon with slightly alkaline water will bring to light large quantities of mucus if that portion is affected, or the use of the rectoscope will accomplish the same result.

Treatment of Acute Form.—The treatment of the acute form consists in freeing the tract from noxious elements—bacteria, improper food, or chemical substances—by a good laxative, and then maintaining the canal in a state of rest until the inflammation has subsided. The first object, if nature has not already accomplished it, is secured, as explained, by calomel, 0.06 gram (1 grain) in divided doses, or castor oil (a tablespoonful). The laity employ this treatment almost without the advice of the physician, and never have unfortunate results but once from its use come under our observation, and then the disease was appendicitis and not enterocolitis. Directly after the cleansing process, the sooner the intestine is quieted, the better, and this can be accomplished by *tinctura opii deodorati* 15–20 drops, or, what has seemed more suitable to me since the ipecac has an influence on the intestine, *tinctura ipecacuanhæ et opii* (liquid Dover's powder) in the same doses. On account of the diarrhea, suppositories are out of the question, but, if the patient vomits, a hypodermic injection of morphine sulphate, 0.015 gram ($\frac{1}{4}$ grain) will have to be given. It is useless to mince matters with small doses, for one generous dose will

accomplish more than a series of small ones. The results of either method of application are very favorable—the tenesmus and colics cease, and the movements become less numerous. No substitute has ever been found for opium to control these symptoms, and an excess of the medicament, followed by a cessation of movements for a few days, can do no harm.

The diet for the first twenty-four to thirty-six hours should be distinguished chiefly for its scantiness. Complete abstinence from both food and drink is best if one can induce the patient to submit, but from fear of too rapid loss of strength, or, as some insist, from an increase of his discomfort by total deprivation, it may be found desirable to offer a demulcent drink, like strained barley or flour gruel, to which some sugar may be added; for, while it has been found that the ability of the duodenum to furnish a ferment which will split milk sugar is restricted, the ordinary cane sugar is easily taken care of. These gruels do not add so much by furnishing nutrition in an assimilable form, since the calories in a bowlful would be but few unless strongly fortified with sugar, as they do by soothing the inflamed surface of the digestive tract. Milk is not advisable at first, for, as explained, the sugar of milk is intractable to the lowered power of the digestive juices, and, even if boiled, it increases the diarrhea. The next step after the violence of the attack has somewhat subsided—say, to three or four stools daily—is the introduction of broths made of beef, mutton, or chicken, freed wholly from fat by skimming the stock, to which well-cooked rice, barley, or sago, rubbed through a fine sieve, or flour may be added, and a slice of toast with fresh butter may be allowed. Should the patient continue to improve, we may next (usually after a week) add a well-beaten egg cooked in the broth, some oysters lightly boiled in their own juice (panned), and chicken or squab. For drinks, albumin water (white of an egg to a cup of water) and cold weak tea, with sugar and a teaspoonful of brandy, works well by quenching the thirst, and does not increase the diarrhea. Arranged in a schedule, these suggestions read as follows:

DIET LIST IN ACUTE ENTEROCOLITIS.

7 A. M.—A glass of albumin water, well sweetened; after three days, a bowl of strained oatmeal gruel, with butter and sugar; after a week a dropped egg on toast, with unsalted butter.

10 A. M.—A cup of cocoa made with water and taken warm, not hot; after three days, chicken broth containing well-cooked rice or barley; after a week, a slice of chicken.

1 P. M.—A cup of cold tea, with sugar and a teaspoonful of brandy; after three days, a sago gruel (sago to be left in water over night and then thoroughly cooked and rubbed through a fine sieve), which may be sweetened; after a week, a cup of hot bouillon, with a beaten egg cooked in it.

4 P. M.—A glass of sugar water, flavored with a little vanilla; after three days, a cup of mutton broth, with rice; after a week, a half dozen cooked oysters.

7 P. M.—A glass of rice water, made as described, by cooking the rice and then sieving, or rice flour may be used instead; after three days, tapioca or arrowroot gruel; after a week, a broiled squab, with toast.

During the night the patient can usually be made contented with occasional sips of cold tea.

This variety of food is necessary, for the patient's appetite is impaired, and the dreaded monotony of the usual diet makes futile all efforts to arouse it. An early experience of ours with typhoid, when a glass of milk was brought us every four hours and nothing else for three long weeks, has led us to attempt variety in a diet, which is often contemptuously referred to by patients as one made up of "slops." If after a week the opium treatment has failed to check the number of discharges, it is desirable to try some of the astringents, and here, with the pharmacopeial preparations and those boomed by proprietary interests, one is often at a loss on account of their multiplicity. The lime salts make an excellent astringent in this case, and a combination of the three best known may be employed to advantage, as follows:

R Calcii carbonatis præcipitati,
Calcii phosphatis,
Calcii subsalicylatis, &c 10.0 or $\frac{1}{2}$ ounce
M. Fac in capsulas XX.
Sig.: One three times daily.

The only complication which needs attention in acute enterocolitis is collapse, and that can usually be checked by hypodermic injections of camphor and oil, most conveniently prepared in ampules, of which the contents of one is to be injected according to the needs of the patient.

Treatment of Chronic Form.—The treatment of chronic enterocolitis is one of the most difficult problems presented to a physician. In the first place, the doctor is very fortunate if he is not the heir to the failures of at least half a dozen practitioners on the same patient,

who can hardly be expected to be in a hopeful frame of mind. Then, every one of the half dozen has had his own individual ideas on the diet to be employed in intestinal catarrh, which, unfortunately for the patient, vary extremely, and are based often on the idiosyncrasies of the last patient the physician happened to treat. Nor is this surprising when such diverse views are expressed by the leaders of our branch of healing—Boas, Wegele, Rodari, Strauss, etc.; hence every patient has notions of his or her own about diet, and has a long list of articles of food which, in her or his case at least, increases the diarrhea. We are, therefore, forced to make a break at once with such notions or to eliminate them gradually. As in the acute form, the diet plays the most important part, and, since the discharges are watery and increased in number, and the articles of food are wretchedly utilized, all we can hope to do is to see that all foods are reduced to their finest practicable form—mashed vegetables, minced fish and meat, gelatine, custards, omelets, and jellies free from seeds and skins. Then, after installing this minutely divided form of diet, we can only watch the stool and note what the results are. Usually starch is admirably taken care of, while meat and fat still persist in the stool in generous quantities. Strange to say, we cannot adapt the diet wholly to the diarrhea, but must make it suitable for catarrh of the intestine, and, as either confined or loose bowels may alternate, we must adjust the diet to meet these conditions, still bearing in mind the irritability of the lumen of the colon. This can be done by inserting or withdrawing certain articles of food which, while equally digestible, have a laxative or non-laxative effect, from a general scheme. For instance, where two or three loose movements with abundant mucus occur a day, we employ the following:

DIET LIST IN CHRONIC ENTEROCOLITIS.

Breakfast.—Cocoa, with a saccharine tablet; one or two eggs cooked in any form except fried; toast and fresh butter.

11 A. M.—A couple of small cheese sandwiches made of stale bread and cream cheese, or plain crackers may be employed; no saltines.

Dinner.—Soup or broth containing rice, barley, or crushed oats (chicken broth, Scotch broth, etc.); picked fish, or minced meats or croquettes; rice or grits; vermicelli or macaroni; toast, with plenty of butter; a wineglassful of homemade elderberry wine or vermouth.

4 P. M.—Same as 11 A. M.

Supper.—Chicken broth or Scotch broth, minced meat on toast, jelly, plain crackers and butter.

Great care must be taken to avoid all vegetables rich in cellulose—spinach, celery, turnip, radishes, salads, uncooked fruit, nuts, rye or brown bread, and jams in which the fruit seeds are still present. The only difficulty with such one-sided diets is that the patients soon tire of them and fail to take enough to maintain their caloric demand. In such cases it may be well to allow a departure occasionally, where the sufferer is permitted to choose his greatest favorite in the gastronomic line—a bit of “high” game, an ice cream, fresh fruit, or an indulgence in champagne, all articles which increase movements, but in the isolated instance often have no effect. Its continuance, however, soon begins to be marked by increasing movements and more “slime,” as it is called by the laity. The constant tendency to under-nourishment must be overcome by increasing the number and amount of the lunches, as we will term them, or we may introduce our ground toasted bread into all liquids.

The medicinal treatment, which begins with efforts to correct the gastric digestion if at fault—achylia by hydrochloric acid and hyper-secretion by atropine—after which we may proceed to the correction of the difficulty for which we were consulted—frequent movements. As we are dealing with a chronic affair, which at the best will take months to get under control, opiates are out of the question. Then, too, bismuth crystals can be seen so often in the stools, with their sharp-angled outline, that one wonders whether they do not irritate instead of soothe, and the bismuth salts (outside of the subsalicylate) have been practically cut out of our armamentarium for controlling the inflammation of the intestine. Pankreon is admirably adapted to this catarrhal condition because usually associated with impaired pancreatic secretion, and, second, since it contains a little tannin, it makes an excellent astringent. One often notices a diminution of the number of discharges; in fact, some patients complain of constipation on its use. Other tannin preparations, like tannalbin or tannigen, in 0.2–0.5-gram (3–8-grain) doses every three to four hours, may be employed to advantage, and, while some may think that these modern products of pharmacy have no advantage over the old-fashioned rhatany and catechu, yet the former unquestionably bring about their results with less disturbance than the latter. Mineral waters, apart from those containing lime and alum, are of little avail. The Bedford alum spring waters have proved very efficacious in checking these long continued diarrheas when associated, of course, with the appropriate diet; while, if one can take the cure at the springs, all the additional advantages, often mentioned, will accrue to the benefit of the patient.

Colon washings, when much tenesmus is present, aid very materially in promoting the comfort of the patient, and may hasten the progress to health, if a mild substance be added to the wash water, like Carlsbad salts (a teaspoonful to a quart). Not much can be expected, however, with reference to a restoration to normal conditions by these means. On the contrary, in our experience nitrate of silver, tannin, dermatol, etc., when added to the wash water, have made the catarrh distinctly worse, and Boas warns against the use of the strong astringents. A hot hip bath at bedtime is advantageous, but whether the abdominal band is of any distinct use is difficult to say; at least the patient derives comfort from its use, and no harm can arise from it.

Now, while we have to consider the catarrh of the intestine as a whole, and probably in a large percentage of those affected the entire tract is involved, still enough instances of strictly localized inflammation, confined either to the large or small intestine, exist, so that we must consider each severally.

ENTERITIS.

Enteritis, or inflammation of the small intestine, exists largely by grace of the fact that time had not been given the individual affected to have an extension into the colon; in other words, either death or recovery stayed the progress of the disease at the ileocecal valve, for otherwise an extension seems certain. The purest cases of enteritis are those accompanying severe burns or uremia where the upper jejunum and duodenum are involved, and phosphorus and arsenical poisoning where the inflammation comes through from the stomach, which is also involved. It seems pretty clear that only one of the criteria which Nothnagel established for the differentiation of enteritis from enterocolitis will stand the test of time, and that is the absence of frequent movements. This has long been known to us from the fact that many a typhoid has passed through its entire course without inducing diarrhea, yet the lesion is in Peyer's patches. In this connection we must take into account the instances of icterus catarrhalis, or, better, acute cholangitis, which often comes in after a disturbance of the stomach or a diarrhea. In the few cases where an autopsy has been had, a plug of mucus has been found in the choledochus, and this has been regarded as a cause of the stagnation of bile, but the cause may be equally as well an invasion of the duct by bacteria from the duodenum and damage of the liver cells by their toxins. There is no fever, but patients complain of symptoms relating to their jaundice,

itching, great mental depression, inability to think clearly, as well as—and here is the significant part—discomfort in the region of the duodenum, fullness and pressure after eating, and localized rumbling and gushes of material in the region of the epigastrium. Frequent discharges occur during the early part of the attack before the jaundice appears, and one has much less opportunity to examine the stool, as the patient's attention is seldom called to his own condition until jaundice appears; then, unfortunately, one finds only the stools of icterus when the evidences of duodenitis have disappeared. The diarrheas which accompany uremia, severe burns, sepsis, and arsenical or phosphorus poisoning have much the same characteristics. There is always an intermediate hemorrhagic or ulcerous enteritis, and the onset is very sudden; the stools are watery and occur with astonishing frequency; the patients complain of abdominal pains, and it sometimes happens that the central portion of the abdomen above the navel becomes locally distended, indicating involvement of the peritoneum. The examination of the stools shows no coarse mucous fragments, but narrow worm-eaten shreds are numerous. Food remnants are visible to the naked eye. Unchanged bile pigment is found in the beginning of the attack, but blood is common throughout, and can usually be recognized readily by the color (chocolate-brown) of the stool, while the reaction is alkaline.

Treatment.—The treatment can offer but little aid for this condition. Its violence and short duration before either recovery or death takes place gives but little time for medical arts. Opium to quiet the intestine and demulcent soups seem all that can be employed. When we are inclined to make a diagnosis of chronic enteritis apart from its association with colitis, more careful consideration will probably show that it is one of the various forms of intestinal indigestion and not a true, enteritis.

TYPHLITIS.

Typhlitis, or cecum mobile, has again begun to arouse the interest of physicians because, while, in the glow of enthusiasm associated with the discovery of appendicitis and the brilliant results accompanying the removal of the appendix, we were, so to speak, swept off our feet and willing to ascribe every discomfort located in the right iliac fossa to the appendix, yet many of us, who faithfully attended operations of our own cases, began to have a marked suspicion, when apparently healthy appendices were removed and subsequently the patient was no better, that something more was at fault for the pain than the inno-

cent looking appendix. Even those surgeons, be it said to their credit, who were removing most of the appendices began the investigation, and their wonderful facilities soon put us back on solid ground. There is, and always has been, a typical perityphlitis and paratyphlitis by peritoneal invasion in which the appendix may not be disturbed in any way and remain perfectly healthy. Then, too, a peculiarly long cecum was often found, and one which from its long mesentery was given unusual freedom of movement, by which it could be pushed to the left of the median line or even up under the liver. Its accompanying symptoms are occasional attacks of colic, with no rise of temperature but abdominal distentions, nausea, and constipation. Thus the restoration of a term and the acknowledgment of a condition, which we older practitioners were allowed to recognize, but of which we have been deprived since everything in that region was appendicitis, not typhlitis, seem fully justified.

The anatomical reasons, apart from the weakened musculature, for these low-grade inflammations and adhesions seem to be an unusually long mesentery, low position and free movement of the cecum, added to the long delay of the fecal matter in this portion of the tract, which makes it the site of choice for most ulcerative processes (dysentery, tuberculosis, etc.). How much adhesions have to do with the dilated cecum, and whether they arise from an antecedent ulcer caused by stagnating fecal contents, food detritus (bone splinters, egg shells, etc.), or masses of round worms, cannot yet be told. At least in a case of which we made a careful study, and which was operated, adhesions were the chief feature in continuing the condition, though their cause remained unknown; at any rate, the appendix was above reproach. The radiogram is here reproduced (Fig. 81).

Symptoms.—The symptoms of typhlitis must necessarily vary according to whether it remains uncomplicated or the inflammatory process extends to the appendix, the entire colon, or the ileum. Furthermore, it is often difficult to differentiate sharply the acute from the chronic form, or, rather, to learn whether acute attacks have ever taken place; at least, the attacks, if acute, must have been of very short duration and have caused no great disturbance of the general health. The most important feature is the colicky attacks, which begin in the right iliac region without the slightest warning and extend in the direction of the navel or gallbladder. These pains may be so slight that only when forced movements are made, like bending, do they stab one, or may be so severe that a cold sweat comes upon the patient's brow, and he must leave whatever he is doing until the parox-

ysm is over, while some vomit and rarely faint. After an acute exacerbation, there is a dull pain in the same region for some time. When



Fig. 81.—Radiogram of cecum showing barium ingested. (Collection of Dr. A. W. George.)

the attack comes on before dawn, as it sometimes does, the patient may be induced to remain in bed, but, if at work, can rarely be persuaded to give it up, for after the attack of pain he declares himself, apart

from soreness, as well as ever. Taking cold, allowing the bowels to become confined, and some article of food are at times accused by the victim of the attack, and, then again, he can give no explanation for it. When chronic, the pain follows no law whatever. A patient of ours, working for a large express company on the floor of the distributing room, was allowed his few minutes for an attack of pain and then returned to work, much as if he had gone to lunch; this continued for three or four years until he was operated on. Nothing noticeable is found on inspection of the abdomen, though, in one case under our observation, pulsation of the right iliac artery was readily seen, while that of the left could not be detected by the eye; this was, undoubtedly, purely accidental. A feature of diagnostic importance, however, is the absence of the right rectal spasm, the "defense musculaire," so common in an inflamed appendix. Palpation during an attack of pain is likely to be painful, but not to the extent that the patient makes a wry face and pushes away the examiner's hand. During the interval the whole region can usually be felt without pain, but deep pressure with two fingers over McBurney's point will produce it. This sensitive zone, however, is not nearly as closely defined as with an inflamed appendix, and tenderness can be elicited above, below, and to the right of this point. On closer palpation, or by bimanual palpation with one finger in the rectum and the flat finger tips over the region, one can usually make out the cecum as a sausage-shaped mass, with one terminus at Poupart's ligament and the other fading away toward the liver. It presents no fixed resistance to the fingers, as it would were it made up of cecum filled with scybala. Much more does it feel like a bag filled with gas and fluid in a state of tension, for sometimes the rigidity relaxes and the apparent tumor disappears, nor is it difficult to obtain gurgling sounds by stripping the tumor in the direction of the ascending colon. Evidently all the phenomena, pain, and the sense of a tumor are due to a paroxysmal rigidity of this section of the large intestine. Practically all patients suffering from typhlitis complain of constipation, either just before an attack or constantly, as manifested by scanty, infrequent, or hardened stools. An attack may also be followed by a spontaneous diarrhea, during which, at first, the stools are noted for their putrid odor, and at last for the abundance of mucus which they contain. One can interpret this sequence in no other way than that a localized cecal inflammation extended to the colon and the local fecal accumulation was relieved. A. Schmidt is not ready to hold constipation responsible for these attacks of typhlitis, and, when such is apparent, would make a spasm of the

colon above the cecum the guilty feature. A slight rise of temperature (99.5-101) may be present, but it is of an ephemeral nature and disappears within the first forty-eight hours, while, on the other hand, many cases occur without any rise in temperature whatever. A corresponding rise in pulse may be observed or it may be absent, while the general view seems to be that there is no increase in the leucocytes, or, at most, they never rise above 15,000.

Diagnosis.—The diagnosis, in spite of the differences in uncomplicated cases between typhlitis and appendicitis, is often very difficult, because perityphlitis and paratyphlitis frequently become associated and then the most skillful diagnostician cannot differentiate above a probability. When, however, we find the nonrigid pear like or sausage-like mass in the iliac region, minor temperature changes, absence of increase in leucocytes, and freedom from muscular spasm, we can usually decide in favor of typhlitis. To differentiate from typhoid, too, may require from twenty-four to forty-eight hours, but the persistence of temperature in the latter, the prominent headache and nose bleed, enlarged spleen, apathy, and later the rose spots, usually clear up the confusion.

Treatment.—The treatment must vary according to whether we are dealing with an acute or a chronic affair. If the former, and we are assured that no localized peritonitis is present, which we can exclude by absence of a marked increase in temperature, wiry pulse, and short, panting breathing, a tablespoonful of castor oil, repeated two or three times daily at three-hour intervals until free movements are obtained, cannot be surpassed for producing immediate results. When the oil is not effective, it may be necessary to employ calomel in small doses, frequently repeated, or infusum sennæ compositum (several tablespoonfuls). In the meantime the patient is to have no food, and, if digital examination shows a rectum packed with feces, enemata of water, soap, and glycerin are to be employed. It is sometimes astonishing to see what a continuance of this treatment will accomplish in twenty-four to thirty-six hours to relieve conditions. At one's visit the next day the tumor of the cecum has vanished, the pain disappeared, and there is only a vague sense of discomfort on palpation; while the patient, who yesterday was dreading an operation, is today clamoring for food. If, as many claim, this is but a milder form of the disease which kills in thirty-six hours and which but few surgeons will consent to operate after twenty-four hours, then it is most pleasantly disguised. When the pains continue after free evacuation of the bowels, 10 drops of laudanum may be given occasionally, or a suppository of extractum

opii and extractum belladonnae $\frac{1}{2}$ 0.02 gram ($\frac{1}{3}$ grain). On the other hand, if the patient looks frail, there is considerable rise in temperature, the pulse is hurried, a digital examination shows no accumulation in the rectum, and there is a suspicion of spasm of the rectus, soothing treatment should precede the evacuant. Opium and belladonna, or a small hypodermic injection of morphia, should be employed, the patient must remain in bed, and hot applications be applied to the affected region. Then we calmly wait until the active symptoms of pain and rise of temperature have subsided, when the intestine is to be cleared out by castor oil or compound licorice powder, either alone or aided by enemata. The diet during the attack is best limited to demulcent soups—bouillon with egg and gelatine; milk in many cases is badly borne. When the attack is over, the patient should not regard himself as cured, as he often does, for there is a latent irritation of the cecum which may flame up at any moment into another acute attack. During this quiescent period, treatment should be devoted to warding off subsequent attacks. If, as the patient always claims, a period of constipation ushers in such exacerbations, then we must fight this condition with our anticonstipation diet, given on page 416. As such constipation is associated with much spasm of the colon, a fact of which we can easily convince ourselves, more is demanded of the physician than that he shall simply say to the patient, "Eat graham bread and greens," for these articles, containing much residue in the shape of cellulose, do not act as well as the fruit juices, sugar of milk, and salted articles of food, like cornbeef and salt fish made up into hash, or the latter into fish balls. Raw vegetables, radishes, celery, cold slaw, and cucumbers or pickles are particularly harmful. Where the stomach shows a faulty digestion, especially where its secretion is diminished, it may be necessary to still further restrict the choice of food and employ hydrochloric acid or pankreon. Use laxatives with the greatest care in this condition, and then only the mildest, like purified petroleum, phenolphthalein, cascara, agar-agar, or rhubarb root may be nibbled. Suppositories of belladonna may aid one greatly during the intervals between the acute attacks by allaying the spasm and thereby checking the pain, which is often very troublesome at night. This medicinal-dietetic treatment may be largely aided by massage, which, even after the first application, produces a sense of relief from tension, and by palpation it may be found that the region has relaxed. When undue pain is produced, which lasts after the immediate application of the hands, there is always a suspicion that more than a typhlitis, a true peritoneal invasion or a chronic appendicitis, is present.

When one is assured that massage is beneficial, further treatment may be left to the patient, who may apply vibration massage (autovibrator) to this region.

The surgical treatment of this condition has found many enthusiastic supporters among the internists, who have been able to relieve many cases in this way when other means of treatment failed. Until we are assured—as we are not yet—that the inflammatory condition comes from the movable or elongated, firmly bound cecum, there will remain some skepticism in regard to fixation or changed fixation of this part of the colon. As to the ileocolic anastomosis, as is done for chronic constipation, our personal experience is limited, but it is highly recommended by others. It would seem as if, when the danger of the operation grows less with better technic, it would be admirably adapted for this disease when chronic and incurable by medical means. What every medical man must object to vigorously, is this indiscriminate removal of the appendix for typhlitis, which does not do an atom of good, and the patient is returned to the doctor still complaining of the pain in his belly. Either do the ileocolic anastomosis for this condition, colleagues, or let the victim alone. Only recently a surgeon reported ninety-eight consecutive appendices removed for chronic appendicitis, in which one can read typhlitis in many of the cases, and rest assured that a large percentage will continue to have their belly-aches.

APPENDICITIS.

Appendicitis (simple and perforative) suddenly sprang into prominence when we of the older rank were comfortably diagnosing all acute inflammatory disturbances in the right iliac fossa as typhlitis and peri-typhlitis, according to the severity of the symptoms, and calmly laying on poultices and awaiting, with bated breath, the ominous wiry pulse and general abdominal tenderness, which spelled peritonitis for a diagnosis, and death to the patient in most instances. This accusation and conviction of the appendix as the origin of much of this trouble was, of course, due to the late Reginald Fitz, whose importance in the medical world, though our instructor, was not recognized by us until we heard his praises sounded in foreign hospitals. At first the surgeon handled an inflamed appendix very gingerly, being content to aspirate after a walled-off abscess could be demonstrated. Then came a series of articles from the prominent surgeons on "When to operate in Appendicitis," to which the apparent answer was, at all times, under all conditions, as long as breath was still in the patient. Now

we have reached an age of reason when we recognize that there are some simple cases which should never be operated, and others are so serious that the patient's chances are better without the use of the knife. In the meantime there are many cases which are included in this middle ground and which the internist as well as the surgeon must recognize promptly. The simple catarrhal appendicitis, where the walls are not involved and there is no perforation, will remain the function of the doctor to treat, while perforation, gangrene, and abscess formation place the patient promptly in the hands of the surgeon, but the physician must recognize those cases liable to go wrong, for from the simplest catarrhal appendicitis there may arise an extension into the walls of the organ, involvement of the peritoneum, perforation, and general peritonitis.

The causation of appendicitis remains almost as obscure as when it was discovered nearly thirty years ago. It is much more frequent among cultivated people than among the natives of the wilder regions of the earth, and much more common among the people of the United States, said to be due to the excessive use of meat and habitual constipation. Still, among the simple-living New England farmers, from tradition, many were victims of "inflammation of the bowels," which in modern nomenclature reads peritonitis and probably appendicitis, and a practitioner of eighty years or more has described to us during our school-teaching days in his village how, on "opening" the corpse, which has been replaced in modern student nomenclature by "posting," he found concrements sometimes in the appendix, which imposed themselves on him as grape seeds or "burnt"—i.e., hard-beans, but which were probably small fecal concretions. Another cause to which is ascribed appendicitis is the colon catarrh, and particularly that confined to the cecum, as well as membranous colitis, but one should not associate these two conditions too closely, for typhoid, in which the cecum rarely escapes wholly, is never accompanied by appendicitis. An exclusive brand of bacteria, metastatic involvement from inflamed tonsils, emboli from septic processes elsewhere, and trauma, have all been suggested as causative agencies, but, apart from the prevalence of appendicitis during influenza, which may have something in it, all the others fail before the investigation of a large series of cases. The best explanation is that the appendix, on account of its lumen, is always filled with bacteria from the colon, which, as long as they pass back and forth through a patent outlet, do no harm. When, however, from the extension of an inflammatory process in the cecum or an enterolith, a closure of the orifice occurs, the same condition is present as in tempo-

rary closure of the eustachian tube, and inflammation arises from the bacteria as it does in the middle ear.

Symptoms.—The symptoms, of course, vary in accordance with the severity of the attack, but in its milder form agree most closely with those given for typhlitis, apart from the peculiar palpitory findings in the former. This simple catarrhal appendicitis may, in fact, run its course without symptoms, as is shown by the fact that the appendix is already ruptured when our attention is first called to it. Still, these are exceptional cases, and, on the whole, the patient describes a sudden attack of rather severe pain in the right lower half of the abdomen, accompanied perhaps by an attack of vomiting and a feeling of malaise, which compels him to give up his occupation and lie down. When the physician reaches the patient, he can indistinctly detect a vague resistance of the abdominal muscles in the region of McBurney's point. By careful palpation, one can discover neither resistance nor a rigid section of the intestine, but tenderness will always be elicited. The patient meanwhile has somewhat recovered and does not seem particularly sick, his temperature is usually normal and never exceeds 100.5° , and the pulse is rarely over 100. The bowels are confined, but may spontaneously begin their functions after the first day or two, or loose movements may follow. This condition usually lasts a couple of days, but on the third the appetite has returned and the patient feels perfectly well. This form of appendicitis is probably more common than any other, is usually described by the physician as a "touch" of appendicitis, and does not require a surgeon unless the patient's condition grows much worse during the first thirty-six hours. This form vastly outnumbers the perforative variety, is found largely in our out-patient clinics, usually after the worst is over and the rigidity of the abdominal muscles has largely disappeared, and, from the numbers appearing, certainly must be a fairly common disease. The onset of the attack is not always so brusque as represented. Very often a period of loss of appetite, confined bowels, flatulence, eructations, and rumbling in the abdomen precedes, and to the self-prescribed doses of calomel, rhubarb, etc., during this period, it has seemed to us, the attack might be due. Furthermore, the onset may be ushered in by a more or less prolonged attack of dull pain in the right lower half of the abdomen, with an occasional exacerbation, and no other symptom. This has been called by some "appendicular colic," and regarded as purely functional, but may be an early stage of the inflammatory process. The pain, perhaps the most characteristic symptom, is at first more or less diffuse, and may be felt almost anywhere in the lower

abdomen, but, under palpation, tenderness is confined pretty closely to the point where the spinous-navel line cuts the outer right rectus. By putting the patient in bed, too, the pain soon localizes. This limitation of the pain does not convey to one any idea where the appendix may be found, for in two cases under our observation—one in which the appendix popped through the wound as soon as made and the other where the appendix was resting on the vertebræ—the pain and tenderness remained the same. Palpation in appendicitis is painful, and is avoided as much as possible by the patient, while in typhlitis it is not. It is felt most severely when the hand is withdrawn (pressure relaxed) than when applied to the abdomen. Pressure, too, applied elsewhere upon the walls is felt at McBurney's point; this is not only true of appendicitis, but also of other affections in the ileocecal region. As a rule, this region is neither distended nor retracted, nor is the muscular spasm so intense that one cannot palpate the points underneath. When one has overcome the muscular resistance, one feels not only no mass, but usually no intestinal parts. Very rarely the cecum and ascending colon can be felt as a contracted cord, but ordinarily the tenderness prevents any actual mapping out of the parts. Whether one can feel the inflamed appendix, still remains very much in doubt, particularly during an acute attack. When anything definite can be palpated in this region, it is much more likely to be the swollen terminal section of the ileum where it enters the cecum, or possibly the latter in a state of spasmodic contraction. Our own experience in palpating an appendix successfully is confined wholly to the chronic cases or intermissions between acute attacks, when at various times it has seemed that the appendix was perceptible. In an acute attack, however, it has never been our good fortune to feel the organ, and we believe that force necessary to overcome the muscular spasm and penetrate the edematous tissues is entirely unjustifiable. The entire gastrointestinal tract is sometimes affected by reflex influences, and an attack of pain is ushered in by vomiting, though rarely not more than twice. This also offers a differential diagnostic point to typhlitis, where emesis is rare. From the same reflex agency we have a temporary constipation, which usually takes care of itself after the irritation is over. It is a great mistake to begin at once to fight this confinement of the bowels with laxatives, as some do. The rarely accompanying diarrhea is difficult to explain, and, fortunately, is rare, for it has led many an incautious practitioner to treat an appendicitis like a gastroenteritis. This may also be nervous, but the better explanation is that an inflammatory disturbance of the general intestinal tract takes place. The

appearance of the patient is not much disturbed in the simple form. In an analysis of 120 cases, Sonnenburg-Kothe found the temperature average 99.5° , the pulse 92, and the leucocytes 15,000, while in 101 cases of the perforative form the corresponding figures were 101 degrees, 112, and 22,500. From such figures, at least, we may learn that in the simple form the departure from the normal is not marked. The chief point, however, is the rapid subsidence of the symptoms after forty-eight hours; if the temperature persists or recurs, we are then to look on the case with suspicion. The hyperleucocytosis is also a very significant guide in differentiating the simple form from the perforative or destructive variety. In the former the number never exceeds 15,000, but, when the purulent secretion stagnates or infiltration of the submucosa takes place, then up goes the leucocyte count. Thus an increase of the leucocytes above 15,000 means a destructive form of the disease, with probable involvement of the peritoneum. Unfortunately, the reverse of this is not true; we may have a destructive septic process of the appendix and fairly extensive peritonitis with a diminution of white corpuscles rather than an increase. The change from the simple catarrhal to the destructive perforative form must always be watched for with great care, for, as the surgeons declare, the mildest form may finally emerge into the most virulent. It will be noted that the patient who for two or three days has been "comfortably sick," as the expression is used, but still retained in bed for precaution, suddenly has a recurrence of pain, which is even more severe than at first, and a sharp rise of temperature, with a possible chill, and evidences of mild collapse. This is the story, provided the patient was seen from the beginning. Much oftener, however, the early symptoms were neglected by him and we see the victim first with the second stage of appendicitis in full swing; the right leg is drawn up to relieve the tension of the muscles, the respiration is shallow because the chest is held on account of pain; there is marked rigidity over the ileocecal region, and more or less prominence with marked resistance, and light percussion will not fail to show dullness; the temperature is always beyond 100.5° and the pulse above 100; the bowels remain obstinately confined, and often urination is associated with pain.

CHRONIC APPENDICITIS.

Chronic appendicitis is a disease difficult to describe because of the recurrences of acute attacks and the marked reparative changes about the organ, produced after the first attack. That any individual who

has suffered one attack is liable within a year to have another is recognized by all; in fact, statistics show that this liability to recurrence can be expressed in figures, which are variously given as from 20-35 per cent in round numbers. When the patient says that after one mild attack of pain in this region, which perhaps did not take him to a physician, he had absolutely no discomfort until his present attack, we cannot speak of a chronic form, but the recurrence of an acute. When, however, the attacks come close together and the patient is never free from discomfort in that region during the interval, then we have a true chronic form. When, finally, the surgeon removes the appendix of an individual with this history, there may be evidences of former inflammatory attacks and local peritonitis in the form of bands or adhesions, which bind the appendix firmly to the colon, to an ovary, or to the parietal peritoneum; kinks are common, and perhaps the appendix may contain encapsulated serum or pus, and at times it must be said, in spite of symptoms, that the onlooker fails to find any change, though the surgeon usually discovers some pathological transformation, real or imaginary, for its removal; in fact, a surgeon's antipathy for an appendix can be likened only to that of a bull for a red article. Then, in addition to these repeated frank attacks of mild appendicitis, we have the form in which no history of an acute attack can be obtained, termed by various authors as "sneaking," "masked," and "concealed." It can at once be seen that the pathological conditions vary so greatly that it is beyond the power of man to diagnose the state of the appendix from the symptoms and palpatory findings, so that we are forced to refer to the disease simply as "chronic appendicitis," with and without exacerbations.

Symptoms.—The symptoms vary in accordance with the form predominant, but, apart from acute accessions, consist of uncomfortable sensations in the right lower half of the abdomen, without actual colicky attacks, but invariable sensitiveness to pressure over McBurney's point. Gastroenteric symptoms of various kinds may also arise, eructations, pressure after eating, and occasional attacks of diarrhea, with discharge of mucus, from reflex irritation of the appendix. The special pain may be sharply localized in the region of McBurney's point, or may be generally distributed over the right half of the abdomen, or even extend to the left. Light pressure, massage, etc., sometimes relieves the dull pain, while occasionally individuals become so accustomed to it that they note only exacerbations. As the muscular spasm is practically always wanting, it is not usually difficult to map out the cecum, and sometimes feel the appendix as a finger-like, sensi-

tive body, lying on the former. Oftener, however, the thickened appendix lies back or to the side of the cecum and escapes palpation. In this connection two aids are offered us—either the bimanual palpation, with one finger in the rectum, or Hausmann's trick of raising the extended leg on the trunk, so as to put the psoas on the stretch, which offers a good table against which one attempts to feel the appendix.

The general health of the patient suffers according to his susceptibility, and very often he or she becomes very hypochondriacal. Women suffer, too, from menstrual irregularities, perhaps from the adhesion of the appendix to the right ovary, and the pain is always accentuated just before menstruation.

Diagnosis.—The diagnosis of the acute form is not difficult, though sometimes gallstone or renal colic, tabetic enteralgias, right-sided pleuritis, right-sided salpingitis, invagination, or incarcerated hernia pose as appendicitis. But much more careful must we be to avoid confusing a myalgia of the right rectus, which, as is well known, may produce a spasm with an inflamed appendix. Such a condition may be brought on by a cold, with a slight cough, by which the muscle is thrown into unusual exertion. Here, though, superficial pressure produces much more distress than deep, and, again, the bimanual examination with the finger in the rectum can be made without a complaint from the patient of tenderness. The diagnosis of chronic appendicitis where no acute attacks have ever occurred may be completely impossible when the general symptoms of indigestion prevail over the local ones and the thickened appendix cannot be felt. Here, however, is where one may meet tuberculosis, cancer, and chronic invagination of the ileum into the cecum, which, of course, must be carefully differentiated.

In no disease is the prognosis so uncertain as in this. In all probability all the simple catarrhal forms will recover as long as they remain catarrhal, but here is where our foresight fails us, and we can say only from day to day that the dreaded extension to the peritoneum has not taken place. For these reasons most internists consult a surgeon, and then perhaps smile when he removes an apparently healthy appendix, but our anxiety is allayed because no further danger can occur.

Treatment.—The treatment comprises largely the solution of the problem whether the patient shall be operated or not. This problem, in turn, is based on the character of the inflammatory process—simple catarrhal or penetrative, destructive, or any other term which one may choose to employ. The former can be well left to the usual

treatment of local inflammation, the latter demands the aid of the surgeon, and the sooner the better. Then, owing to the unfortunate tendency of the simple form to become destructive, it may be necessary at any moment to interrupt the medicinal treatment and interpose the surgical. The difficult point, and the point on which physicians and surgeons do not always agree, is, when has a simple appendicitis become a destructive one. This period the advocates of the early operation would place at twenty-four hours after the first pain arises, while others place it at forty-eight hours if alleviation of the symptoms has not occurred. In our estimation it is entirely useless to talk about a restoration to health in twenty-four hours. True, in forty-eight hours the spontaneous pain, rise in temperature, and increased pulse may subside, but the tenderness on palpation remains for some time longer. The more we study appendicitis, however, the more we are dissatisfied with fixed time limits. One person will show more disturbance in eighteen hours than another in forty-eight hours, and, still, at operation the lesion may be practically the same. Nothing impresses itself on one more than the individuality of every case, and the decision as to simple or destructive form must not be made according to the clock, but according to symptoms. Whenever a rise in temperature, an increase in pulse, a chill, or greater rigidity of the muscular spasm of the abdomen occurs, or these are continuous when found at the first examination of the patient, then the surgeon is to be called at once and the physician is to be guided wholly by his advice. When, on the contrary, slight rise of temperature, pulse under 100, and moderate spasm continue longer than forty-eight hours, with no accession, we may proceed confidently to treat the patient medicinally, with no great fear of the outcome. If in rural districts a surgeon cannot be readily reached and a cottage hospital is in the vicinity, there can be no objection to the removal of the patient to it, so that both physician and surgeon may watch the progress and a prompt operation performed in case of necessity, but, on account of the surgeon's animosity toward the appendix, as mentioned, he is not always the safest adviser as to the necessity of operation.

Let us take it for granted that no operation is needed. Are we to treat our patient with laxatives or opium, two well-recognized methods of management? It may be said, as Clarke first remarked, that opium "puts the intestine in splints," but at the same time it dulls the pain, our most valuable guide in determining the severity of the process. Again, for the milder cases castor oil has proven almost miraculous in its action, removing all symptoms in the simple catarrhal form in

twenty-four hours. It has, further, proved to us how much more common the simple form is than we supposed, yet there can be no question that, if the appendix shows any tendency to assume the destructive form, any laxative certainly does tear up new-formed protective adhesions and has undoubtedly caused more general peritonitis than any other agency. At least, in our experience the worst forms seen were those where the patient, on his own responsibility, had taken large doses of calomel or compound cathartic pills. An interesting volume has been published on "what to do before the doctor arrives," but here is an instance where what not to do would be more valuable. When, however, the pain is moderate, the general condition not much impaired, and the patient declares that only inadequate or irregular stools have occurred, we may give 1-2 tablespoonfuls of castor oil, as in typhlitis, or our calomel in divided doses. When, on the contrary, the pulse is hurried, the pain more intense, and spasm marked, while there is no history of preceding constipation, 10 drops of laudanum twice a day will dull the pain without eradicating it, and allow the physician to make some estimate of the severity of the disease. A suppository of extractum opii and extractum belladonnæ ââ 0.02 ($\frac{1}{3}$ grain) once a day will usually serve the same purpose. Hypodermics of morphine are absolutely contraindicated unless the suffering of the patient is excessive and a speedy operation has been decided on. A repetition of the dose of opiate should always be delayed until the patient clamors loudly from pain, or palpation of this region arouses distinct suffering; else the physician will live in a dream of his patient's recovery until collapse shows that a rupture has taken place. An application of an ice bag to the painful region is a worldwide custom, but its weight is often objectionable, and its power to subjugate inflammation far below the surface is doubtful. A hot water bag placed against this region, with the patient on the side in bed, so that the weight of the bag is not sustained by the abdominal wall—or, better, when it can be procured, the electric pad—is vastly more grateful to the patient, and particularly with the opium treatment, where we are trying to check peristalsis of the intestine and alleviate pain, much better adapted. The diet should be of the blandest character—oatmeal, barley, or tapioca gruel, or, better still, if the patient is well nourished, complete abstinence from food for a couple of days. Even when the symptoms subside after forty-eight hours, it is not wise to allow the patient to immediately resume his former life, but he should be kept quiet on a couch for a week at least.

The chronic or recurrent appendicitis has nothing before it but an

operation—naturally during an interval. The majority of these sufferers have three to five years of discomfort behind them, while the best skill of many physicians has been exercised on them. They should always be warned, however, that complete recovery will not immediately follow an operation, for adhesions are usually numerous and some will reform. In case the patient declines operation, much can be done by massage, provided no acute attack has occurred within six months. The exudate, which can sometimes be felt, will be found to grow smaller as massage continues. Every effort should be made, too, with the anticonstipation diet—sugar of milk, fruit juices, honey, agar-agar, and petroleum—to prevent the accumulation of feces in the cecum, thereby improving the circulation in those parts.

COLITIS.

Colitis is much more common as an entity than an inflammation of the small intestine. One reason for this is that the inflammatory process, starting in the ileum, readily makes its way through the ileocecal valve into the colon, but the reverse course, from the large to the small intestine, is not so easily accomplished on account of the peculiar configuration of the valve, which allows reverse peristalsis only under pathological conditions. Then, too, the longer delay of the feces in the colon renders it more liable to irritation; even the small intestine, with its five to six times greater length, retains the food only three to four hours, while the passage of the feces through the colon requires twenty hours. It is not true, however, that all parts of the colon are equally susceptible to these injurious influences. Those portions with angles through which the feces pass with difficulty on account of mechanical hindrance—like the cecum, flexures, sigmoid, and rectum—are the most liable. Furthermore, colitis shows a vastly greater tendency toward recurrence and chronicity, and is much more under the influence of reflex (uterus and ovaries in women, prostate and bladder in men) and central nervous influence (vagotonus) than the small intestine. Another strong tendency of colitis, unshared by the small intestine, is to form adhesions by the extension of the inflammatory action (pericolitis) to the adjoining structures. On account of the various manifestations of colitis, it will be necessary to discuss inflammation of special sections, like the sigmoid and rectum, under subdivisions of colitis.

The causation of colitis may be the same as that of enterocolitis, from which the small intestine quickly recovers, leaving the colon

chronically inflamed, or the original disease may have been confined to the colon, as in elimination of mercury in specific treatment, or entrance of bacteria orally or through the blood, as in dysentery. The delay of the feces in the colon, encouraged by the various loops and distortions of which that part of the colon is liable, also has its influence. Furthermore, the common occurrence of polypi in the large intestine and the less common one of malignant disease, which always manifest themselves in the early stage as a colon catarrh, will account for some instances. The colon also proves itself much more susceptible to the invasion of tuberculosis, its favorite site being the anus, sigmoid, and cecum. As stated, it does not require a very severe attack of colitis to lead to ulcers, which in turn attack the submucosa, the muscular structure, and the peritoneal layer, though no symptoms pertaining to the peritoneum may be noted on account of the violence of the catarrhal symptoms. The frequency with which these adhesions are found at any operation requiring the opening of the abdomen shows how common this sequence is.

Symptoms.—The symptoms of the acute attack do not differ to any extent at first from those of an ileocolitis, already described on page 434. The stomach is much less liable to be involved, and, if affected (vomiting), it is only temporary. The stool soon changes, however, and consists of almost no food material, but large amounts of mucus and blood, or, rather, bloody mucus, are passed after severe abdominal cramps and followed by painful tenesmus. While there is marked disturbance of the general health at first, even presence of chills, this soon passes off; the appetite returns, and there remains only this incessant desire for stool, which awakens the patient at any hour of the night and must be gratified in order to secure relief from the distress. There is also a painful sense of cramp in the rectum, and vesical tenesmus, with frequent micturition, may accompany it. The painful cramps and tenesmus gradually disappear, but the frequency of movements continues, so that, as some patients express it, "they are never sure of their intestine"; the call to stool may come at any moment and is imperative. Recurrent attacks of the acute form may occur or the disease develop into the chronic state.

Physical examination verifies the inferences from symptoms. The temperature at first often reaches 102 degrees, the abdomen is somewhat distended, but never to such an extent as to interfere with palpation. When tenderness is elicited, it is not over the entire colon, but at certain points, like the cecum, flexures, or the sigmoid, though the colon may be found contracted in its entire length. When the spasm

of the anal sphincter can be overcome and the rectoscope introduced, the rectum will be found intensely reddened with punctate hemorrhages and covered with blood-stained mucus. The feces in acute colitis at first contain food particles from association of the small intestine, but in a short time the stools, which up to this period have been liquid, may assume a hardened consistency, or, strange to say, some stools may be found solid and others liquid on the same day, made up very largely of bands and shreds of mucus, rolled up and thoroughly impregnated with fecal matter, in which absolutely none of the recognized food elements—starch, fat, and meat fibers—can be discovered. On the contrary, attached to the mucus, when freed from fecal matter (suspended in distilled water over night), are found all forms of leucocytes, some erythrocytes, multitudinous epithelial cells in every stage of granular transformation, with well-preserved nuclei. Again, shreds of mucus may be fished out of the stool when the lower section of the colon is involved, with no admixture of fecal matter whatever. Innumerable bacteria can also be seen, and the addition of a drop of iodine solution brings out clearly many microorganisms containing granulose. The bacterial examination in these sporadic cases offers but little light as to the causation, but should be made where several cases occur in the same vicinity, to exclude the possibility of an infectious dysentery (Shiga, Flexner, etc.). As the stools grow less numerous and less and less mucus appears in them, it is still found that painful sensations persist at the hepatic and splenic flexures, while tenderness to pressure can also be elicited. There is no question that at these points, on account of the frequent difficulty of forwarding the fecal contents, the inflammation persists long after the colon is restored to its normal state. This, perhaps, is not so vividly brought out in the acute as in the chronic form, where these points seem to be the only parts of the colon affected. The severity of the attacks varies so widely that they seem to be different forms of disease. We may have a few slimy discharges and the affection is over, or there may be so many bloody mucopurulent discharges that the patient is completely prostrated, and the disease assumes the type of a peritonitis. The abdomen may be distended, hard as a board, and extremely painful; here Sonnenburg would make use of the blood count for differentiation. Colitis is never accompanied by more than 10,000 leucocytes—at most, 15,000—while, of course, peritonitis has no limit. There may be a small amount of albumin in the urine and hyaline casts. True peritonitis may occur from colitis, as stated, but restricted usually to well-defined sections of the tract, the sigmoid (perisigmoiditis) and the

cecum (perityphlitis). Thrombosis of either femoral vein (milk leg) may also occur from the infection. When pericolitic complications manifest themselves, the temperature, which perhaps had subsided, shoots up again, the pain increases, sometimes a muscular spasm is found over the affected site, and palpation discloses an extremely tender spindle-shaped mass about the colon. This may be readily detected when it occurs at the cecum or sigmoid, but is vastly more difficult to detect at the flexures, where the symptoms may be ascribed to gastric ulcer, cholecystitis, etc. This is particularly true of some pericolitic processes, which begin *de novo* without the preceding period of frequent painful movements. These pericolitic inflammatory processes, too, are responsible for the adhesions found so often between the two branches of the hepatic flexure, and less often the splenic.

The differentiation from the enterocolitis is made chiefly by the persistent absence of food particles in the stool, and from typical typhlitis and appendicitis by the absence of blood-stained, loose stools in the latter; though, as we have learned, appendicitis may be sometimes accompanied by frequent slimy movements. One should be cautious in predicting the outcome of an acute colitis. Old people often succumb to prostration, and young people can never be promised a freedom from chronicity. Young men of perfect physique, even athletes, have come to us with a chronic colitis which was the outcome of only one acute attack, and treated according to the most approved methods.

Treatment.—The treatment, unless the stools are free from fecal matter when the patient is first seen, should be ushered in by a couple of tablespoonfuls of castor oil, which is superior to calomel on account of the possibility that the latter may produce an ulcer of the colon. Then the use of laxatives is to cease, and, to control tenesmus, a suppository of opium and belladonna may be employed. Certain drugs have won some renown against that form of colitis known as dysentery, which may also be used in noninfectious varieties, but not always with the same excellent results. Ipecac is one of these, which, in the form of a powder, in doses of 0.3 gram (5 grains) can be given twice daily, with an initial dose of 5 drops of laudanum to check the nausea. This remedy cannot be profitably employed more than two days in succession, but after a short interval another two days' treatment can be carried out. Enemata are indicated very early in the course of the disease, and a vast number of medicaments have been suggested and employed, some successfully and more unsuccessfully, in combating the disease. One must refrain from this treatment, however, as long as there is marked tenesmus, since the patient cannot endure it, and

the retention is so short that nothing can be gained. A teaspoonful of Carlsbad salts, dissolved in a quart of warm water, may be the earliest used because the least irritating, and it serves very well to clean out the mucus when the inflammation is low down in the tract. Two grams (30 grains) of bismuth subgallate added to a cup of thin starch or gum arabic suspension, with 10 drops of laudanum, can be introduced slowly and often retained all night, with decided benefit to the colon, as evinced by lessened mucus and diminution of stools. Gentle massage of the abdomen after the enema causes it to become more widely distributed through this portion of the intestine.

The dietetic treatment is very simple. Only liquid food, gelatine, cocoa, and broth, as long as examination of the stools shows any participation on the part of the duodenum, should be given; then soft boiled eggs, toast and butter, chopped meat free from fiber, and light puddings—like rice, cottage, tapioca, etc.—can be employed, but a return to the customary mixed diet must be forbidden until the stools are formed, and particular precaution should be taken against vegetables with much cellulose, like greens, lettuce, turnip, cauliflower, and cabbage.

CHRONIC MUCOUS AND MEMBRANOUS COLITIS.

Chronic mucous and membranous colitis should really be considered under the acute form, but there is so much uncertainty as to whether many of these cases ever had any relation to a sudden onset and were not, so to speak, chronic from the beginning, that we hesitate to link them up with the former, though the name implies their relation. Then, there are still doubters of the fact that they are really inflammatory at all, and would bring them under the nervous disorders, much as an attack of asthma. At least the history of each case shows disturbed defecation, now incomplete, now restrained over a day or two, very many nervous manifestations, and the description of occasional discharges of almost pure—i.e., unmixed with feces—bands and shreds of mucus, which may be preceded by severe attacks of pain. When, however, one follows by examination of the feces the course of a case of this sort, one finds in the interval with no pain that the feces are filled with more or less extensive shreds of mucus, having numerous epithelial cells embedded, which, it is true, at times are more or less dependent on an emotional influence and which may increase until it far exceeds in quantity the feces eliminated. This, to us, indicates a low degree of colon catarrh, and while, as Da Costa and others main-

tain, the emotions play an important part, they cannot originate mucous or membranous colitis—whichever one chooses to call it—for they are one and the same. A. Schmidt compares the relation existing as closely allied to that of bronchitis and asthma. There is a constant secretion of mucus, though it may not be of sufficient amount to annoy the patient, but from some emotional cause the muscular structure of the bronchi is thrown into temporary contraction or spasm, and there is a flood of mucus eliminated. Many French and American authors would prove a close connection between intestinal gravel or sand and mucous colitis, making both a manifestation of uric acid diathesis, but, as the sand is almost always made up of calcium phosphate, carbonate, and oxalate, stained with hydrobilarubin, and not of uric acid at all, and, furthermore, constant examination will bring to light as many instances of intestinal sand where no mucus exists as vice versa, such ground is not tenable. The thickened bands (membranous), which are often so opaque that they are unfitted for microscopic examination without sectioning, do not differ from ordinary mucus, according to A. Schmidt, except that 9 to 10 per cent of fat is impregnated in their substance. This form is not soluble as ordinary mucus is, but is coagulated like the shriveled epithelial cells. No change has taken place, however, in the excretive action of the colon, except an exaggeration of this normal function of fat elimination. The most active cause of this variety of colitis is functional constipation, particularly that form associated with spasm of this section of the intestine. The irritating action of dried feces in producing spasm has been described under constipation, to which reference is made. Others believe that the spasm is produced by a colitis from other causes and often produces the constipation. This cannot be absolutely denied, and there is every reason to believe that we have a vicious circle, the constipation aggravating the spasm and this, in turn, delaying the passage of feces. Another well-recognized cause of membranous colitis is the displacements and distortions of the colon, which are so commonly associated with similar displacements and pathological conditions of the genital organs in women, which make that sex a participant in this disease to the extent of 75 to 90 per cent. Strange to say, too, the genital disease is always looked on as the sole pathological condition present, and the profession is disappointed when a radical removal of tubes and ovaries fails to cure the symptoms. On account of the intimate association of nerves and blood vessels of both uterus, adnexa, and colon, we may consider the affection of the genital organs as primary, but closely allied to the colon in all neuroses. Again, one

often notes the presence of a mucous colitis with a deep urethritis from gonorrhreal origin or from a persistent pyelitis and nephroptosis. Others arise from self-abuse of enemata in treating constipation, particularly in cases where 4 quarts of water are introduced by the widely advertised "cascade" or internal bath. Two of these have come under our observation and we doubt not there are many others. In some instances, of course, this condition arose from an acute attack, which was so far back that the patient cannot remember the particulars. Others have maintained that mucous colitis arises from a chronic appendicitis, but in our opinion the reverse is true—that any person suffering from chronic catarrh is more liable to inflammation of the appendix; at least the removal of the appendix never relieves any case of mucous colitis.

Symptoms.—The symptoms are much varied, and have a different course according to the nervous susceptibility of the patient. As a rule, they come on very gradually, and only a few can recall an acute attack. There are periods of comparative freedom from discomfort and then an interval is interposed when the patient's declaration is that "life is a burden." Practically all the victims describe periods of constipation, and state that, as soon as these set in, the pain and discharges of mucus are markedly increased. Women, too, complain of an increase in discomfort during menstruation, while others declare that any emotional influence—anger, sorrow, or disappointment—increases the severity, showing a strong nervous element. It becomes manifest by rumbling of the bowels, a feeling of fullness, which the patient declares to be due to gas, though his abdomen is flat or concave-shaped, and a feeling of insufficient defecation, or often actual pain in some portion, like the flexures. Again, actual colics occur, which at first are difficult to differentiate from gallstone or appendical colics. Patients tell us that their pain is constant, unaffected by the amount or character of the food, but, though they have an excellent appetite, they are afraid to eat to satisfaction, and most of them are thin and apparently undernourished. The abdomen is an obsession with them, and a constant observation of the stool (which is their custom) does not relieve in any way their overexcitable nervous system. The sharp attacks of pain, from which some do not suffer, but have a dull, steady pain, are dreaded more than anything else, and many attacks occur without any warning or preceding restriction of stool. At first, before the pain has reached its climax, the sufferer can localize it in the right (ascending) or left (descending) abdomen or in the median line (transverse colon), but after a time it streams over the entire abdomen, cold sweat

covers the brow and face, and they roll on the floor or bed, pressing their hands over the epigastrium or lower down. During these attacks of pain the abdomen is not distended, but rather contracted, as in lead colic, nor is tenderness so pronounced that one cannot indulge in deep palpation. Rapid pulse and pinched features are wanting, so that there can be no peritoneal involvement. During the colic—but, better, in the intervals—long stretches of contracted colon can be detected and rolled under the fingers, while before them such portions of the colon are soft and elastic, and gurgling can be heard and gushes of fluid felt. The cecum is apt to be found relaxed, while the sigmoid is almost invariably in a state of firm contraction. The stomach, too, may be found somewhat lowered and succussing readily, while either one or both kidneys are prolapsed, and in women the ovaries are tender. The introduction of the rectoscope is occasionally difficult on account of spasm of the lower colon, but oftener can be introduced to the distance of 25 cm. without any trouble, owing to the relaxation, which we suspect may be due to the enormous enemata which these victims sometimes employ, as explained. Some boast that they can introduce 4 quarts into the bowel. No redness or ulcerations can be discovered in the lower colon, since the process is ordinarily higher up.

The examination of the stools should not be limited to one, but several examinations, when the complaints of the patient in regard to scanty defecation are found to be justified. No formed stool is usually found, but the feces are made up of small dried scybala. Exceptionally, however, a change to semisolid or even liquid stools may take place, but only temporarily, and those burdened for a long period with this disease will state that not for years have they had a formed stool. Even if the stool is formed, instead of a large cylinder, more or less coherent, it will be found to be made up of bands and lead-pencil-like masses, which fall apart as soon as the stool is passed; the color is dark and the odor not fetid, unless there is much decomposing mucus in it. In uncomplicated cases no food remnants will be discovered, though occasionally one finds numerous fatty acid needles, which indicate an intestinal indigestion, but not in any degree an enteritis. The most suggestive thing visible is the mucus, which is always more excessive after a colic, when the entire stool may be made up of bands of mucus (tapeworm form), with scarcely a fragment of fecal matter. Rarely, however, is this extreme reached, but usually out of the mass of macerated feces, suspended in water, one can remove large gray or colorless masses of mucus, either clear as crystal or cloudy (fat). The softer the stool, the more thoroughly is the mucus mixed with fecal

material, and naturally the latter condition presages a higher site in the colon for the origin of the mucus. This mucus is differentiated from that derived from the small intestine by having no food fragments attached, and by the fact that its epithelial cells are well retained instead of the mere presence of nuclei alone. These variations in the character of the stool depend largely on the site of the disturbance. If the upper reaches of the colon are affected, the stools are liquid and the mucus exists in small fragments; if the lower, the stools are solid and the mucus is found in long bands. Then there may be periods when no mucus at all is discovered, and these periods usually accompany the remissions when the discomfort of the patient is less. Pericolitic involvements of mucous colitis must be rare. Still, cases have come under our observation where the x-ray showed marked delay of the bismuth at the flexures, and exploratory operation demonstrated adhesions, even when no history of acute colitis could be obtained. It is always well to bear in mind the possibility mentioned of exacerbation of the colon catarrh in case of pyelitis or renal stone, and, when pain is markedly fixed on one side of the abdomen or the other, the urine must be carefully examined for this complication. The patient's general health, particularly his nutrition, always suffers, and the victims are spare and thin. Whether this is due to impaired absorption, which is improbable, so rarely does one see any extensive food residue in the stools, to increase of temperature, which others describe, but which we have never seen, or to fear of food and restricted eating, cannot be positively stated. Our opinion is that the last is the real cause. Further, this fear of eating is one of the various manifestations of an unstable nervous system, whether the cause or result of the colon catarrh is still in dispute. Only in marked enteroptosis, with occasional excessive discharges of mucus, can one possibly regard the nervous condition as primary and the cause of the disease.

Diagnosis.—The diagnosis of this disorder is not particularly difficult, except in elderly people, where the loss of flesh, gurgling, and localized pain may lead one to suspect malignant disease. Here a radiogram is of great aid, because, while it shows delay in the passage of the bismuth, it does not show obstruction, and the content is found to make its way through the spasmodically contracted portion without any lessening of the stream, though the narrowed portion can be seen. The prospects of relief are fair, but the prospects of cure are poor—placed by some authors as low as 50 per cent. Our experience can boast of no cures in the sense that no recurrence ever takes place, except perhaps where in an instance or two a surgical operation re-

lieved the patients of their constipation and discharge of mucus, but the hypochondria, which is often most distressing to the patient and his friends, is very reluctant to let go.

Treatment.—The treatment is best begun by keeping the patient in bed and attempting to overfeed, so as to overcome the undernutrition, which always exists. Then, too, strange to say, the movements of the bowels will sometimes take place spontaneously from the rest, and relaxation of the nervous system. When acute attacks of pain occur, a hypodermic of morphine is about the only means that will check it, and, after the pain subsides, one can proceed to the real treatment. This consists, first, of a rigidly controlled diet, which should employ the fruit juices—grape, orange, grapefruit, cider, etc.—sugar of milk, honey, molasses, and articles of food containing salt. Another point to be observed is that the diet must be ample. At least three large and three small meals should be taken daily, which both increase the nutrition, a much needed desideratum, and also produce a more copious mass of feces, which aids intestinal peristalsis. To accomplish this purpose, one has to use much persuasion, because the patients all have a preconceived notion that a too generous diet increases their distress, but no physical evidence of injury from this abundant feeding can be detected. Often the combination of ample food and rest in bed are sufficient to improve very decidedly faulty defecation by making it more regular, and under these influences the stools become once more formed. When this effect is not prompt and the delay is caused by the colon spasms, these can often be overcome by a nightly suppository of extractum belladonnae, 0.02 gram, which should be continued even after stools occur every twenty-four hours. If with these means the stools are not formed and regular, there should follow twice a week a colon washing with a rectal tube, either by the patient or the physician, using at least 2 liters of tepid water, containing either a teaspoonful of sodium bicarbonate or borax in divided portions of about 250 c.c. each, of which the last portion should be allowed to remain in the colon, and, by massage in the direction of the cecum, caused to flow as much toward this point as possible, and retained all night. In case there is no fecal accumulation in the rectum, a mild laxative, like cascara sagrada, tamarindien, or phenolphthalein, should be used. The oil injections of Fleiner have been used by us faithfully in many cases of membranous colitis, but with varying success. Many report the ejection of the same amount of oil in the morning without fecal matter, while others declare their dull ache at the flexures has been increased. It is difficult to conceive how such results should occur,

unless the oil increases the spasm by the effort to pass it through the narrowed portion. At least a trial may be made twice a week until it is found that no relief is derived from its use. The efforts to treat the mucous membrane of the colon directly are usually made with a weak starch or gum arabic olyster to the amount of a cupful, which should contain two grams of bismuth subgallate or ichthyl. This is to be introduced very slowly into the rectum and allowed to remain as long as the patient will retain it. All stronger substances, like silver nitrate, collargol, etc., should not be employed, for they always increase the mucus and spasm. Gentle massage will often reinforce other means for the control of this disease, and faradism has also been known to aid, but beware of the use of either of these means exclusively to the rejection of all other methods. The almost universal hypochondria which accompanies this disorder cannot be managed at home. Of that there can be no doubt, and our most persuasive powers are always directed toward procuring a change for the patient; whether it shall be to a sanitarium or to a resort—North in summer, South in winter—depends largely on the patient's circumstances. If the patient is a woman and is found to be suffering from some disturbance of the uterus or ovaries, these should be treated first or synchronously with the colon disease. After a long period of fruitless medicinal treatment, one thinks of surgery, and it must be acknowledged that an implantation of the lower ileum, either in the sigmoid or lower end of the descending colon, has relieved many—whether by first correcting the constipation cannot be told. Stitching the opened appendix in a wound in the abdomen and flushing the colon through this has proved valuable in dysentery, but in our opinion is worthless in membranous colitis. Removing existing adhesions, we think, is worse than useless, as they are sure to return, either at their original site or elsewhere.

ULCERATIVE COLITIS.

Ulcerative colitis (dysentery), a form always accompanied by copious purulent discharge and also by ulcers, is the severest phase with which we have to do. Ordinarily the cases are extremely rare, but during the return of our troops from tropical parts a few came under our observation. The condition was called at that time "chronic dysentery," but it was not that, for, whatever may have been its origin, at the stage at which it was seen no specific microorganism could be isolated from the stools. The ulcers, which may be minute or as large as a half dollar, are always multiple, have as a favorite site the

rectum and the sigmoid, but have been found as high as the entrance to the ileum.

Symptoms.—The symptoms are noted for their remissions. Attacking the young or middle aged, the disease will subside for a short time only to break out again with renewed vigor. Its onset may be acute, oftener subacute or gradual; its active period is accompanied by fever, the patient becomes anemic and loses weight rapidly. The chief subjective symptom, and the one to which the victim ascribes his improvement or his greater impairment of health, is the number of stools, which reaches six to ten daily. With the increase of the discharge, too, the amount of blood, mucus, and pus also becomes greater. These numerous movements are particularly brought to the patient's attention because of the blood, though ordinarily unaccompanied by pain. Further, pain of any kind, either persistent or spasmoid, is usually absent; in fact, no painful sensations are aroused until the inflammatory process invades the peritoneum, producing pericolitis. Objectively, during the fever-free period we note in our patient the pallor and emaciation. While the victim may not look particularly thin when dressed, the prominent ilia, clavicles, and ribs indicate the great loss of flesh. The pallor, too, is justified by hemoglobin content, as low as 40 per cent. The appetite is usually good, and the patient does not complain of distress or eructations. When the abdomen is examined, one is struck by its concavity; it slopes from the iliac crests to the vertebral column, on which its surface seems to rest; the skin has lost its fat and will stretch like a piece of rubber; the colon is tender, particularly at the sigmoid, and is found in a state of spasm. Rarely is any portion relaxed; in fact, in one sufferer, so emaciated was he, the sigmoid was distinctly visible on the surface of the abdomen. When with the aid of a cocaine solution (20 c.c. of 1 per cent) the rectoscope can be introduced, the entire lower colon is found intensely injected, filled with granulations, which bleed on the slightest movement of the tube, and numerous ulcerations can be distinctly seen.

The feces are distinguished, first, by the blood, which may be so excessive that it may be called a "bloody stool"; then, too, pus is present in appreciable quantities, and here lies the most distinguishing proof of the ulcerations, though Rosenheim declares that pus may be present without ulcers; leucocytes are in a state of fatty degeneration and often show vacuoles; mucus, too, is present in shreds and bands, but the more apparent it is the more scanty are the pus and blood. When the process extends well up to the cecum, the odor is

often putrid, but ordinarily the stools are odorless. It is rare that any food remnants are found in the feces, unless occasionally starch when vegetable food, improperly prepared, is ingested. When an acid reaction is present, the lower ileum in this case is not above the suspicion of participation. The bacteriological examination of the stools has never shown any uniformity in the species found predominating. Probably the colon bacillus is the most prominent, but it is generally conceded that its presence is secondary, and Zweig alone is willing to hold a peculiarly virulent form as responsible for the ulcers, but he says there must be a concomitant colon catarrh.

The complications of ulcerative colitis are often severe. Besides the invasion of the peritoneum and local perisigmoiditis, general peritonitis, with fatal termination, has arisen from it. Thrombosis of the femoral veins, polyarthritis, and endocarditis may occur. More recently, too, the ulcers have been shown by the radiogram, in which the smooth contour of the content at the site of the ulcers is broken.

Diagnosis.—The diagnosis comprises chiefly the differentiation from mucous colitis, which is not difficult. The scanty mucus or absence of mucus can be utilized, and the presence of numerous leucocytes means either the rupture of an adjacent abscess into the canal, a dysentery, or an ulcer. The first possibility can usually be eliminated by palpation, which will locate an abscess of any size. If the abscess is low down, a digital examination by the rectum will usually disclose it. True dysentery can be excluded only by the absence of its peculiar microorganism (Flexner bacillus). The prospects of recovery, taking into account the complications, are rare. A. Schmidt places them at 50 per cent, but, of the three cases under our observation for a long time, one died and two improved, but the latter drifted out of our care before complete recovery had taken place.

Treatment.—The treatment can rely very little on dietetic aid unless food particles are found in the stool, which, as stated, is uncommon on account of the rare involvement of the small intestine. The withdrawal or diminution of the carbohydrates in the food when starch granules and microbes containing granulose are found, checks to a certain extent the diarrhea, but the result is temporary, and a return to free carbohydrate diet soon causes the recurrence of the numerous stools. Rosenheim, on the contrary, regarding the putrid odor as due to faulty albumin digestion instead of the presence of foreign elements (pus and blood), as it probably is, withdrew practically all albumin from the diet and fed his patients on milk and flour products. His success was only a limited one, but shows that

colitic processes may be aggravated by intestinal indigestion, and should be managed as it is as far as diet is concerned. Every article of diet, however, must be offered in its most minute form, so that absorption may be hastened and as little residue as possible allowed to enter the colon.

The medicinal treatment is still confined to a few favorite preparations, from which too much must not be expected. *Pulvis ipecacuanhae et opii* or the tincture of the same may be used, in doses of 0.6 gram (10 grains or mms.) three times daily, or bismuth subsalicylate, tannigen, or tannalbin in half-gram (8-grain) doses may be employed. Colon washings with solution of boracic acid (2-4 per cent), salicylic acid (1:500), hydrogen peroxide (1-2 per cent), or suspensions of bismuth subcarbonate or subgallate, may be used, 2 grams to the liter. Tannin and silver nitrate have never been employed by us since Boas' warning against their use. All of these substances are much more effective when employed through the appendical fistula. When passed into the tract with a colon tube, it is much better to dissolve or suspend the medicinal agent in a starch or gum arabic clyster, add a few drops of laudanum, and never use more than a cupful. All efforts to use larger quantities and thus distend the colon, so that the remedial fluid will enter all the interstices, as it is described, are invariably harmful rather than beneficial. Of the treatment through the rectoscope with dry powders blown in with a powder blower, we have had no experience. If the ulcerative process is low down, within 27 cm. of the sphincter, it may be applicable, but, if higher up, as it often is, no apparent good can come of it. Here, after medicinal means have been exhausted, we must proceed to surgical intervention, which consists in either an artificial anus at the cecum, or, on account of the annoyance of liquid stools, at the descending colon. Both of these operations are intended to free the portion of the colon below it of fecal matter, and can also be used for flushing; this operation counts many cures to its credit. The various anastomoses of the ileum to the midtransverse colon, sigmoid, or rectum are much less effective, for, though it relieves a portion of the colon of its feces, it leaves no means for treatment of the ulcers above the transplantation. The establishment of a cecal valve or the opening up of the appendix stitched in the abdominal wall, which does not have the disagreeable features of an artificial anus, since no fecal matter escapes, but allows a complete flushing of the colon from cecum to anus, has been fully as effective as when the feces were excluded. Then, again, after restoration to normal is established, the closure of this small aperture is

a trifling matter; hence this will be the operation of choice unless some other condition makes one of the others imperative.

SIGMOIDITIS AND PERISIGMOIDITIS.

Sigmoiditis and perisigmoiditis, as an entity, was for a long time in doubt, and as yet, pathologically, they still have a rather weak basis for their existence, though clinically they seem well defined. In the first place, this condition is often confused with proctitis on the one hand, and may spring, on the other hand, from the mucous membrane of other parts of the intestine by extension or from antecedent gonorrhreal or other inflammation of the ovaries in women. Still, the sigmoid, on account of its tortuous course, its freedom of movement, its thick muscular walls with narrow lumen, and its constant content of thickened fecal masses, seems, like the cecum, particularly prone to inflammatory processes, produced either by the entrance of infectious bacteria through the injured mucous membrane or the irritation produced by hardened scybala. The position of chronic sigmoiditis, however, is much better assured than that of acute, and has long been known from its surgical aspect. Its chief characteristic is swelling of such an extent and of such firmness that it is often mistaken for cancer and operated under that false diagnosis. Here, too, the mucous membrane injury is of little import, but the thickening about the intestine is so great that obstruction occurs, or abscesses may form, as in the acute, and break into the intestine or bladder, or, as in one case, under our observation, into both, so that feces and flatus were passed by means of the urethra. Further investigation of the pathology of this disease has shown that small perforations of the muscular coat exist in this region, by which pockets are formed by the mucous membrane extending through these and resting on the peritoneal layer, in which the decomposing fecal particles set up serous inflammation. Of course this limited sigmoiditis must be differentiated from tuberculosis, syphilis, and dysentery of other parts of the colon which have invaded the sigmoid.

Symptoms.—The symptoms of the acute form resemble very closely a destructive appendicitis, but on the left side; in fact, a true appendicitis may cause an extension of the inflammatory process to the perisigmoid region, or, rarely, the cecum may be found lying on the left side. The disease begins with fever and intense pain on the left side, which may or may not be preceded by a longer or shorter period of constipation. In mild cases which do not go on to abscess formation there

may be no fever, nor any of the signs of severe peritonitis, vomiting, meteorism, and collapse, but extreme tenderness and a moderate spasm of the superficial muscles. The sigmoid can always be felt, however, as a tender, sausage-like mass, lying along the left iliac and followed with the fingers into the lesser pelvis. The bowels are usually confined, and, when stool is either spontaneous or induced by enema, the feces are made up of small hardened balls, covered with mucus, which is either blood stained or mixed with pus. Under appropriate treatment the tumor usually subsides, but it may increase and terminate in an abscess outside of the sigmoid, with severe general symptoms, chills, vomiting, etc. In still severer cases the perisigmoiditic or peritonitic symptoms prevail almost from the start; the pain does not remain confined to this locality, but shoots into the left leg and bladder, the least movement causes pain, and even urination is painful and scanty; the patient vomits once or twice, the face is sunken, and the extremities are cold and bloodless. The danger of a general peritonitis is much less in sigmoiditis than in appendicitis. Usually the affected area is quickly walled off from the general peritoneum, the exudate is easily mapped out by palpation, is painful, and, unless relieved by surgical means, the pus may make its way into the various cavities in the immediate vicinity. A third way is open to the abscess contents, absorption, which has often occurred, but it presents too many risks to be voluntarily chosen, and frequently leaves sigmoid strictures behind.

The chronic form steals in without any temperature or violent suffering, and is usually well established when discovered; yet, whenever an abscess forms, we have the same train of symptoms as follows a similar occurrence after the acute form. The chronic form is more likely to arise after, if not from, a long period of constipation, acute dysentery, or, what is remarkably common, after an appendicitis, whether operated or not. The patient usually comes with the story of increasing difficulty in securing a daily stool, with now and then an attack of diarrhea, accompanied by much "slime," as he terms it, which may or may not be blood stained, and increasing pain in the left lower abdominal region, which may become colicky. The sufferer, in spite of ample food, is thin, having lost much flesh, and feels weak and sick. Unless some of the complications mentioned have occurred, the manifestations, apart from these, are wholly local. On palpation of the seat of the pain, the sigmoid can be easily felt of greater or less dimensions—hard, smooth, and well defined, or its outline fading off into the surrounding tissues (perisigmoiditis). The sigmoid has lost to a large extent its motility or may be firmly fixed, while very often

hardened fecal masses may be felt in the adjoining portion of the colon above. Rectal or bimanual examination offers no light, since no obstruction of the lumen is found, nor can we determine whether there is simply a thickening of the intestinal wall or an adjacent tumor. Under ether the hardness of the mass may subside somewhat because it is, partially at least, due to spasm, but, as anesthetics do not always subdue intestinal spasm fully, we dare not rely on this test alone. The feces offer but little light; they are usually hard and in lumps, but may be semisolid. When hard, they are generally in small balls or of small caliber, indicating the narrowing of the gut at its lower portion. This is consistent with the sense of fullness and frequent defecation with the deficient stools of which the patient complains. Mucus is abundant and often blood stained, or red blood corpuscles may actually be found. Furthermore, the feces never contain any food remnants, and do contain evidences of inflammation of the lower colon in the shape of mucus and blood or blood-stained shreds of the same. By these features and their sudden change of character we may distinguish this condition from simple colitis, but much less easily from cancer.

The rectoscope also furnishes great aid in the detection of this condition. While the mucous membrane of the rectum shows no change as we approach the rectopelvic angle, we find the surface is reddened, bleeds easily, and shows small erosions which are covered with mucus. At the same time the passage narrows, and the air which is blown in fails to enlarge the caliber, so that it is often impossible to reach the flexure; when, by care, this is accomplished and the tube inserted a distance of 30 cm., the reddening can be seen to have begun to disappear, indicating a purely local process.

Diagnosis.—The diagnosis, apart from confusion of a localized process with a general one, chronic mucous colitis or dysentery, may be confounded with a local abscess arising from inflammation of the adnexa in women, as in a case under our observation, where pain on the left side, frequent loose movements containing mucus, and, later, leucocytes with much tenesmus and a pyemic temperature, led to a diagnosis of perisigmoiditis, which operation showed to be a suppurating dermoid cyst adherent to the sigmoid and at that time discharging into it. Then, too, there is the constant danger of confusing early cancer with chronic sigmoiditis in elderly people, and the best means of settling this question is by the use of the rectoscope. A livid color of the mucous membrane and much edema is in favor of malignant disease, though no firm epithelial new growth is found. Furthermore, the rigid resistance offered to the further introduction of the tube after repeated

efforts increases the likelihood of the same pathological condition. On the contrary, a marked disproportion between the size of the mass to the symptoms, its smooth surface, and lack of motility are significant of pure inflammation rather than malignant disease. It is a well-recognized fact that there may be pericolitic inflammation with adhesions in any part of the colon, but these differ from perisigmoiditis in that there is vastly greater disturbance of the mucous membrane in the former; in fact, we might assume that perisigmoiditis may exist *de novo* at times did we not know that the infection comes from the lumen of the tract. In the rest of the colon these stricture-forming external inflammatory processes, as are found at the sigmoid, rarely occur except at the cecum and the adjoining ascending colon.

Treatment.—The treatment must necessarily vary with the form and severity of the disease. If a simple sigmoiditis, one can treat it the same as a catarrhal appendicitis—by rest in bed, liquid diet, an ice bag or, when this is objectionable to the patient, an electric pad applied to the painful region. It is much better to empty the bowels with enemata of oil and soap suds, or oil alone, rather than by laxatives. Castor oil should not be employed unless there is absolutely no danger of a rupture of an abscess and the patient declares that a long period of constipation had preceded the attack. If a free movement has been secured, the bowels must be kept open, which can often be accomplished by the liberal use of fruit juices and honey. A return to an unrestricted diet, particularly to those articles of food which contain a large amount of cellulose—cabbage, onions, and uncooked vegetables like lettuce, radishes, and celery—should be deferred as long as possible. When perisigmoiditis occurs, the temperature and the leucocyte count should be followed closely, and at the first signs of suppuration a surgeon should be summoned to free the pus as soon as an abscess is discovered in order that perforation into bladder or general peritoneal cavity may not take place. In chronic cases of the elderly, exploratory operation is much more often suggested by the surgeon for fear of malignancy. Internal treatment has been proposed for the chronic cases, and consists either of the clysters containing dermatol, ichthyl, or iodoform, as are used in ulcerative colitis, or the use of these powders applied directly to the diseased section of the colon through a rectoscope by means of a powder blower with a long nozzle. The only effective surgical treatment is, naturally, the complete resection of the diseased portion, but this is often so difficult and so jeopardizes the patient's life that a preliminary colostomy above the sigmoid is performed, and, by irrigations with the various medicaments mentioned,

an attempt is made to restore it to its normal condition. If this cannot be done, or any suspicion of malignancy arises, a second operation may succeed in its removal and the patient's life be saved.

PROCTITIS AND PERIPROCTITIS.

Proctitis and periproctitis form the last division of localized inflammation of the large intestine, and, while now the diseases of the lower section of the colon have passed largely out of the hands of the gastroenterologist into those of the rectal surgeon, still the former should have at least a working knowledge of this condition. This localized inflammation is only to the slightest degree the outcome of a similar process higher up. When suffering from severe diarrheas, the patient often complains of the burning in the rectum and anus, and of the cramplike closure of the latter after each movement. This is undoubtedly due to the irritation of the decomposed inflammatory products, and usually disappears after the attack is over, but may persist as a result of hemorrhoids, polypi, fissure, etc. Hence the greatest number of attacks of proctitis arises from local irritation, be it mechanical, as scybala, retroversion of the uterus, which rests on the rectum in women, injury from hard rubber or metal rectal tubes, or unusually irritating enemata, or even pinworms and the consequent pruritus and scratching. Or, in spite of the fact that the anal sphincter closes so tightly that microorganisms rarely pass through, we may have a proctitis set up by gonorrhea, particularly in women, by extension from the genitals, which does not differ in any respect from that produced in other ways. In men it is much less common, and may be explained by lack of cleanliness. This extension is most common in children, and in the acute form is especially painful and distressing, while in the chronic form it may be barely noticed. The mucous membrane of the rectum seems particularly susceptible to mechanical injury, as can often be noticed by simply expanding its folds, thereby causing superficial lesions. Hence small ulcerations may extend through the muscular coat to the subserous layer, where small abscesses form, which may break into the rectum again or burrow into the lax tissue about the rectum and form the so-called "fistulas," which are common. Nor does the injury end here, for often from this entrance of bacteria may spring many cases of periproctitis.

Symptoms.—The symptoms in the acute cases begin with a sense of intense fullness in the rectum, which may increase to paroxysms and

with pain, which streams to the bladder, genitals, and up to the left lower abdominal region. Sitting is impossible and walking and standing painful, so that the patient is usually forced to seek his bed. With the pain begins an intense desire for defecation, which innumerable visits to the lavatory do not stay, and, in fact, after a time no fecal matter passes, though the tenesmus remains the same. At first, after strong bearing down, the anal sphincter is opened and a little fecal matter is ejected, but more often only intestinal secretion. The discharge of this causes intense burning, the sphincter closes spasmically after it, and the tenesmus begins anew. Very often this tenesmus is imparted to the bladder, and retention or, more often, frequent and painful micturition adds to the patient's torture, which may be increased still more by the prolapse of the rectal mucous membrane through the anal opening. The general health suffers also on account of the loss of sleep, lack of desire for food, and, not unusually, a slight feverish attack, which, if the inflammation is confined wholly to the mucous membrane, soon subsides, but, if continued to the perirectal tissue, may be of some duration.

Physical examination by the eye alone may show only a slightly reddened anal opening, with perhaps hemorrhoids and a small fissure, which are only complications. With the introduction of the finger into the rectum, which is often difficult and sometimes impossible on account of the spasmodic closure of the anal sphincter, one feels the mucous membrane hot, extremely sensitive, and covered with bloody mucus or with a bloody purulent secretion, which remains attached to the finger when withdrawn. When the rectoscope can be introduced, which is sometimes impossible, but should always be preceded by a small amount of 1-2 per cent cocaine solution, the reddened mucous membrane with small bloody erosions can be seen. By this means one gains a knowledge of the severity and extent of the process, and, if the rectal fold can be reached, one notices its restriction to the rectum alone. The feces are always scanty, and, on account of the sphincter spasm, are ribbon-like or pencil-shaped. When delay in the sigmoid has occurred, they are pebble-shaped and cause exquisite torture when passed. Very often, too, they are covered, but not mixed, with mucus, blood, and pus. The more of the last that is found, the more severe is the process. While this is the usual appearance on account of the abundant intestinal secretion, these fecal fragments may become dissolved or liquefied, and real diarrheal stools result. If due to gonorrhreal infection, of course a smear of the pus on the slide when stained readily shows the gonococci. When the process extends from the

mucous membrane to the surrounding tissue, a marked change takes place; the symptoms increase in severity, the temperature rises, chills may be present, throbbing occurs, and the tissues around the anus become hard and brawny, excessively tender, and, when an abscess threatens to break out, raised and reddened. If about to point in the rectum, the finger will usually discover the hardened spot, and, if fluctuating, surgical aid should be sought at once.

The chronic form is usually much less troublesome and much more durable. There is fullness in the rectum, but it is not excessive, and the patient's attention is first called to his illness by mucus and blood in the stools. There is, however, a most intolerable pruritus, which is aroused by an accompanying anal eczema. After long duration it is found that the sphincter does not close tightly and allows a certain amount of the secretion to escape with the flatus, thus producing the eczema.

Rectoscopic examination, which in the chronic form is never difficult, shows a bluish-red mucous membrane, with prominences, due to swelling of the follicles. As causes we have oxyuris, or often blind fistulæ, which have a narrow opening into the intestine above the sphincter.

The complications and sequelæ of proctitis consist chiefly of hemorrhoids. These dilated veins about the anus ordinarily cause little trouble, rarely bleeding at defecation, but, when they become inflamed, form hard, painful kernels, and microorganisms pass through the thin mucous membrane and still further increase the irritability of the rectum. In addition, by the passage of hard stools the delicate superficial layer of the mucous membrane becomes torn, and fissures or, rather, shallow ulcers, long and narrow, result, which are in the folds of the anus and can usually be exposed to view only by putting the surface completely on the stretch, so that these folds vanish. This act only at defecation may cause any pain. These fissures are often very difficult to find because they produce a sphincter cramp, which increases the folds and buries them still deeper in the sulci formed. Of course above the anal ring they cannot be found except with the aid of the rectal speculum or rectoscope, whose introduction must always be preceded by the use of the cocaine solution on account of the pain induced. Even the smallest of these may produce intense pain in defecation, which causes the sufferer to restrain the act as long as possible, which, in turn, aggravates the proctitis. In some instances the fissures are the result of an anal eczema, produced by the discharge from the proctitis, as described, combined with the effects of scratching.

From the periproctitis we have the fistulæ, as explained, which may open into the rectum, externally beside the anus, commonly called "incomplete," or in both localities, when they are regarded as complete. These are always discharging a small amount of pus, and from the entrance of fecal matter, or infectious products, may penetrate deep in the tissues. Very often of a tubercular nature, they cause little discomfort, but are instrumental in keeping up the proctitis, and, innocent and superficial as they look, the introduction of a flexible probe will show deep incursions into the surrounding tissues.

Diagnosis.—The diagnosis should never rest on mere inspection and digital examination, for by these means, even aided by the ordinary rectal speculum, one can rarely obtain full knowledge of the condition present. With an inspection of the stool, however, and the use of the rectoscope, it is not difficult to determine the severity and extent of the disease. At the same time this gives us some idea of the cause, whether secondary to ulcerative colitis, dysentery, tuberculosis, malignant disease, worms, gonorrhea, fissures, or fistulæ. When this has been determined we may also offer some opinion as to the outcome, which is usually favorable in simple catarrhal, uncomplicated proctitis. In the chronic form, one comes on a protrusion of the lower portion of the rectum (prolapsus ani), caused by paralysis of the sphincter.

Treatment.—The treatment consists, first, during the active stage of insisting that the patient remain in bed, and, second, in checking the tenesmus as soon as possible by *tinctura opii deodorati* in doses of 15 drops every few hours, according to results, or a suppository of belladonna and opium may be used. The almost incessant straining of the patient at stool, to relieve himself of what he regards as a full rectum, must be discouraged as much as possible for fear of a rectal prolapse, as well as from the fact that the congestion is always increased by this act. The diet should be largely liquid, as completely free as possible from residual matter, which can be accomplished by straining all the food given. After one or two days, when the tenesmus has somewhat subsided, which can also be aided by hot hip baths, one can proceed to the employment of enemata, consisting of salt solution (6:1.000), or flaxseed tea, used in quantities not larger than a cupful at a time, to which 15–20 drops of laudanum should be added. Later the regular Fleiner injections of sweet oil may be employed; these should always be only tepid, for any higher temperature causes rapid rejection by the inflamed intestine. After the severer symptoms have vanished, we may proceed to treat the cause. If gonorrhreal, we may

use protargol suppositories, 0.02-0.1 gram ($1\frac{1}{3}$ - $1\frac{1}{2}$ grains), or weak solutions of silver nitrate (1:3,000, increasing to 1:1,000) through a double current rectal tube. When the nonspecific forms have not disappeared in from eight to ten days, it is wiser to apply the dusting powders—dermatol, iodoform, etc.—through the rectoscope than to rely on the astringent injections, where one cannot see what is being accomplished. This employment of powder directly is peculiarly the domain of the chronic form. Fissures, fistulae, and hemorrhoids are amenable only to surgical treatment. The first can be healed by complete stretching of the sphincter and lightly cauterizing the defective mucous membrane. The second, if incomplete, must be opened freely and drained; if complete, must be laid open by cutting through the sphincter and curetted. The last must be treated by the destruction of each nodule with the actual cautery, which, if skillfully and not too extensively applied, leaves no chance for subsequent injury and rarely produces stricture. Many still treat fissures, while the patient is engaged in his daily pursuits, by restraining the stool several days and by a daily application of dusting powder (aristol, calomel, or iodoform); then by a large dose of castor oil the bowels are to be freed from their accumulation and kept open until the fissure is healed. This method is adapted only to superficial breaks in the mucous membrane. Hemorrhoids, too, have been treated by an injection of each nodule with 1-5 drops of a glycerine-carbolic acid solution (equal parts) under the usual antiseptic precaution, as well as the protection of the mucous membrane by vaseline. After the insertion of a fine hypodermic needle into the piles and injection of the solution, the needle should remain for a short time until coagulation of the blood has taken place. Confinement of the bowels by opium for three days, and then a free purge by means of castor oil, usually completes the cure. Whether it is fully safe to allow the patient to go about, or, as some advertise, "without detention from business," is not so certain. At least the safest way is to keep the patient in bed during this treatment.

CHAPTER XVII

ULCERATIVE PROCESSES OF THE INTESTINE AND THEIR SEQUELÆ

In the discussion of inflammation we have come on ulcers, as, for instance, in the colon following severe colitis, but the general tendency of all such processes was to invade the peritoneum and eventually cause adhesions. Here is a group of ulcers, essentially chronic, whose etiology is still rather imperfectly understood, resembling more the gastric ulcer, which, as far as is known, never arises from inflammation. The general causes of these ulcers may be stated as, first, pressure of the hard fecal masses on the mucous membrane in the rectum, sigmoid, and flexures of the colon, and, second, stretching of the intestinal walls, by which the blood supply is diminished; or embolism of the veins may occur, both leading to localized necrosis, which accounts better for the ulcers of the cecum where the stools are rarely solid. Ulcers, too, may occur with nephritis in the lower ileum and the upper colon, dependent, as is supposed, on the irritation produced by ammonium carbonate, arising from decomposing urea, which, as is well known, is eliminated largely by the intestine. Furthermore, it has long been believed that we may have ulcers from burns of the body, whose favorite site is the horizontal portion of the duodenum; ulcers from septic disease, particularly endocarditis, which are probably due to embolism; ulcers from arsenical, phosphorus and especially mercurial poisoning, the last of which occurs from the long continued use of medicinal doses, situated in the colon and produced by the elimination of the metal; finally, we have ulcers from amyloid disease, pernicious anemia, and leukemia, and, of course, from any neoplasm of the intestine, particularly in the later stages of its existence. In all of these, however, the original disease so overshadows the effects of the ulceration that the latter is often only accidentally discovered from the evidence of diarrhea, which is not always constant, or from blood in the stool, either grossly (tarry stools) or by chemical tests. The fact is that ulcers of this character have no clinical history at all, and a diagnosis is difficult. It is markedly different with another group of ulcers, which are not an accidental accompaniment of another disease,

but have an entity of their own. Among the best known of these are the duodenal and tubercular ulcers.

DUODENAL ULCER.

Duodenal ulcer is proving much more common than was supposed, since operations have been more freely performed for its relief. The old statistics, based on the autopsy records, showing its presence in 0.3–0.4 per cent of all those undergoing a postmortem, have been emphatically changed by records of the surgeons, who have found the duodenal twice as common as the gastric ulcer. Another reason for the discrepancy between the records of the pathologists and the surgeons is that the latter have an opportunity to examine the site of the scar during or soon after its activity, while the latter examine the intestinal canal of one dying of intercurrent disease long after the occurrence of active symptoms, when the scar is very thin and barely perceptible. All agree, however, that duodenal ulcer is much more common in males and in those well advanced in adult life. There is no question that the duodenal, as well as the gastric, ulcer is caused by digestion, since it is always found in that portion of the intestine bathed by the acid gastric juice. Ulcers below the entrance of the common duct are a rarity. This ulcer, too, is often a complication of other diseases, particularly those which impede circulation—arteriosclerosis, nephritis, and septic processes—through thrombosis or embolism, while Boas is convinced that the abuse of alcohol plays an important part in its production. To burns of the body a much greater rôle has been assigned than is justifiable, for Rosenbach, in 130 autopsies of those dying from burns, could only find one unquestioned ulcer of this character from that cause. The position of the ulcer is usually directly beyond the sphincter in the great majority of cases; in fact, so closely are many duodenal and gastric ulcers united, both in position and causation, that many prudent diagnosticians designate them by the two terms united by a hyphen, leaving it to the surgeon to establish their site; others are not more than 3 cm. from the sphincter and practically never beyond this.

Symptoms.—The symptoms may be so marked that a diagnosis, at least of gastroduodenal ulcer, is easy, but in many instances the symptoms, apart from indigestion, weakness, and pallor, are so vague that a copious hemorrhage is our first warning of its existence. The accident rooms of our hospitals have a considerable number of such cases, where the patient is never conscious of being ill until the accident happens.

No case of unexplained pallor should be passed over lightly, but the meat-free feces must always be examined for chemical blood, whose presence may be the first distinctive sign. In frank cases, pain and its peculiarities may of themselves establish a diagnosis. It comes on suddenly in the upper abdomen, to the right of the median line, when the patient is apparently in the best of health; there may be vomiting of a small amount of sour-tasting fluid. This pain ordinarily lasts from two to three hours for several days in succession and then disappears for a time, during which the sufferer eats what he chooses without discomfort, but it invariably reappears. Those attacks come with such regularity and disappear so quickly that one is almost inclined to regard them as the crises of tabes. Such attacks should never be passed over without examination of the stool for blood, which will usually be found; in fact, these are the forms which, as stated, are often brought to the hospitals in a state of collapse from a terrific hemorrhage. These attacks may, perhaps, be called recurrent or periodic, but we also have a form which is more chronic and which stays with the patient until permanent relief from gastroenterostomy is acquired. Here the patient complains constantly of pain in the upper abdomen, under the xiphoid or in the right loin, two to four hours after eating. The time varies markedly, but is usually constant for the same individual and kind of food. When liquid food is taken, the pain appears earlier than when solid. The pain does not depend on the character of the food beyond the time of its occurrence, as in gastric ulcer, where liquid food may cause no pain whatever. Directly after eating, the pain is much relieved and may completely disappear for the time being; hence Moynihan's term, "hunger pain." As the patient is usually in the possession of an unimpaired appetite, he hastens, as soon as the pain occurs, to partake of some solid or liquid food for relief. Two explanations have been offered for this relief by food—one, that its introduction causes, for a time, a spasm of the pylorus and prevents the acid gastric contents from irritating the ulcer, and, another, that the acid of the gastric contents is diminished thereby. The x-ray examination, however, shows that the food begins to enter the duodenum promptly, and pain occurs only at the end of gastric digestion; when the stomach is absolutely empty, the pain ceases. The "hunger pains" and sour eructations at the end of digestion are not unlike similar symptoms in hypersecretion, except that in duodenal ulcer the gastric contents may sometimes show no increase in acidity; in fact, a lessened one. This is a somewhat suggestive condition in diagnosing duodenal ulcer—subjective signs of hypersecretion without any increase of such

secretion. Here, too, are remissions of symptoms for months, only to recur with their former severity. While many claim to make a diagnosis from symptoms alone, still the objective examination of patient and feces is necessary to insure us from mistake. One of the most constant observations made is that the feces contain chemical blood. This may not be detected the first time, but a subsequent examination



Fig. 82.—Radiogram of duodenal ulcer. Outline defect at A shown by arrow. (Collection of Dr. Atrial W. George.)

will probably show it. Profuse hemorrhage, with tarry stools, is only a complication, and we should discover the blood long before this occurs. Unfortunately, cases have been known where no blood could be discovered, but a week or two later excessive hemorrhage took place. Therefore, if no blood is present, we cannot absolutely exclude duodenal

ulcer. A second most reliable sign is a distinct tenderness on the right side of the abdomen, above the navel, in the parasternal line. In some cases this occurs only during the prevalence of the pain, and may be accompanied by rigidity or spasm of the right rectus. Furthermore, there is always a point which is tender to pressure in the back, to the right of the last dorsal and first lumbar vertebra, while in a few instances a light blow upon the spinous processes of the third and fourth dorsal may be found painful. The examination of the gastric contents shows relatively increased acidity in comparatively few instances, but digestive hypersecretion or continuous secretion from its irritation are not uncommon. The x-ray examination is of the greatest aid in establishing a diagnosis.

A study of these radiograms shows a rapid early emptying of the stomach, the duodenum drawn markedly to the right and apparently fixed when adhesions have occurred, a marked filling of the first part of the duodenum, and, later, a cessation of gastric movements, so that long after the stomach should be emptied (six hours) there is still a distinct residue in that organ. Furthermore, it is not unusual, after the stomach is empty, to find a small residue of bismuth attached to the duodenal wall, above which a small air bubble may sometimes be seen. To summarize, then, there are the concealed cases of duodenal ulcers, marked by anemia and increasing weakness, those accompanied by duodenal crisis, and, last, those associated with "hunger pain," which come and go with various lengths of remissions, with chemical blood in the feces and well-marked tender points front and back, as well as occasional hypersecretion of the stomach.

Complications.—The complications accompanying the chronic form so obscure the original disease that they offer the greatest difficulty in diagnosis. By adhesions of the duodenum to the liver or gallbladder, the common or hepatic duct may be so twisted that bile may be found in the urine, and typical gallstone colics may occur, when at operation the gallbladder may be found free from stones or cholelithiasis. An adhesion to the head of the pancreas, too, by causing a kink in Wirsung's duct, may produce abundant neutral fat and muscle fibers in the stool when the pancreas itself is free from disease. Bands, also, may form which, by kinking or moderately constricting the duodenum, cause constant vomiting, which leads one to think of gastric ulcer. In such a case under our observation, confirmed by operation, the vomitus was also deeply stained with bile. These complications, perhaps, demand oftener the aid of a surgeon than the original disease itself.

Treatment.—The treatment must necessarily be the same as that of

gastric ulcer, described on page 311—rest in bed, liquid diet, etc.—until the period when we feel assured that internal therapy will be of no avail. This point has been reached when, in spite of treatment, several periods of pain, with intervals of freedom, have been passed, or when the feces show continually traces of “occult” blood, indicating that the ulcer has not healed, when we must summon the surgeon to our aid. In a gastric ulcer where the patient has reached a point when coarse food can be taken without discomfort, we may well suppose that the ulcer has healed, but this is not so in a duodenal ulcer, where the character of the food plays no part at all, nor can the absence of blood in the feces prove absolutely that the ulcer has cicatrized. A long continuance of freedom from pain after medicinal treatment will show the probability of permanent cicatrization of the ulcer. To this end, bismuth undoubtedly aids, which, as subnitrate, subcarbonate, or subgallate, may be given in doses of 0.5 gram ($7\frac{1}{2}$ grains) three or four times daily. Furthermore, on account of the frequency of recurrence, the patient, after an ostensible cure, must be warned against any excess in diet (condiments, highly seasoned food, etc.) or the use of alcohol, and advised to report to some physician twice a year for examination.

INTESTINAL TUBERCULOSIS.

Intestinal tuberculosis, next to typhoid and dysentery, is the most common cause of ulcerations of the intestine. As a complication of pulmonary tuberculosis, produced by swallowing the sputum, it is very common, being found at autopsy in 50–60 per cent of all cases. The primary form, or that resulting from infection from food or other substances entering the digestive tract, is extremely rare, and is found chiefly in children. From the pathological institute at Kiel the figures are 28 instances of primary intestinal tuberculosis out of 600 autopsies, while those from Breslau are 13, of whom 8 were children, in 1,100 autopsies. Although the discussion has been long and bitter, there is but little question that the milk of tubercular cows may produce this form of tuberculosis, as well as butter and cheese made from the product of those cows, and the meat of tubercular animals.

The pathology of these ulcers is dependent on the fact that the bacilli become entangled in the follicles of the intestine, various follicles unite, and finally the process breaks through the mucous membrane, and we have the full-fledged ulcer. These exist chiefly in the lower ileum and the colon, may remain simple ulcers, or by granulation tissue produce tumors, particularly at the ileocecal valve, or may extend until

they become annular and then produce stenosis. The rectum is also a favorite site, and many a fistula about the anus is of tubercular origin. Less often, and only once in our experience, has a tumor of tubercular nature been found at the sigmoid, similar in every way to those found at the cecum. Peritoneal effusion often accompanies, and an ulcer may break into the peritoneal cavity, with the result of fatal peritonitis.

Symptoms.—The symptoms, of course, are largely diarrhea and emaciation, but the former does not necessarily occur, nor should we regard every victim of pulmonary tuberculosis as the possessor of intestinal ulcers because he has diarrhea. Unless there is a stricture, there is no pain preceding or accompanying the stools, nor is there intestinal rigidity or gurgling. The stools number from four to eight daily, and are dependent not so much on the number of ulcers, which may be confined to one, as to the normal or abnormal condition of the remaining mucous membrane. These movements bear no relation to the kind of food, though many a patient will mention certain articles as productive of diarrhea. The feces are liquid, of a dark color, alkaline reaction, with all the food remnants present, without preponderance of any one, and fine shreds of mucus from the small intestine, distinguished by the adherence of partially digested epithelial cells, with nuclei intact, and numerous individual nuclei are present.

The tubercle bacilli, of course, occur; but, if pulmonary tuberculosis also exists, the presumption is that they come from the swallowed sputum, unless found in or attached to these masses of mucus, which should always be properly stained when the bacilli are suspected, and, when found in such fragments, these bacilli can be utilized to their fullest extent in favor of intestinal tuberculosis. Blood is rarely present in more than the merest traces, to be detected by chemical means (Weber), and a profuse hemorrhage would exclude a tubercular process on account of the slow and gradual onset of the latter. Pus is never found except in the tuberculous fistulæ already mentioned. When pain is present, it is not colicky, but steady, and not severe. Palpation can sometimes elicit slight tenderness, but the parts of the intestine cannot be mapped out, showing that they are flaccid, nor is there any spasm of the superficial muscles. In fact, in a case recently under our observation the woman, though suffering from pulmonary and intestinal, as well as peritoneal tuberculosis, complained more of the small amount of fluid in the abdomen than from the other conditions. There is sometimes moderate distention of the abdomen, such as one would find in typhoid.

The general condition always suffers severely. The constant disturbance of sleep by the diarrhea, the fear of the patient that eating increases it, and oftener the lack of appetite, soon bring the victim into a state of extreme emaciation; in fact, a mere skeleton. Of course a part of this is due to the accompanying phthisical process, but primary cases show the same changes. A rise of temperature, with erratic changes known as pyemic, with nightly sweats, also accompanies the primary as well as the secondary form, showing the absorption of pus-producing bacteria into the blood. A marked anemia, often of the type of pernicious, is associated with the disease, and persists even after recovery of the local condition by cicatrization. The course of the disease is steady, and it terminates usually in death after the diarrhea has become well established.

The complications are most often the extension to the peritoneum, with exudation and infection of the glands. Rupture and fatal peritonitis may happen, but are rare. The strictures resulting from these ulcers may produce sudden occlusion or ileus when their presence was not suspected, though a part of this stenosis may be due to spasm. Stenoses from this cause are more apt to be multiple, which increases the difficulty of diagnosis.

The ileocecal tumor, found usually during the period between 20 and 30 years, begins very gradually, with loss of flesh, pallor, failing appetite, and diarrhea alternating with confinement of the bowels. Soon there is a sense of weight and discomfort in the right lower abdomen, increasing to pain as soon as signs of stenosis appear, as they undoubtedly will. Then the middle of the abdomen is found somewhat distended, and the alternating rigidity and relaxation of the small intestine indicate promptly where the obstruction lies—at the ileocecal valve. At this time, too, if not before, at the same site a tumor-like body can be felt, immovable, either smooth or sometimes nodular, generally painless, and with its length exceeding its breadth. Fever may or may not accompany, but with all tubercular involvement of the intestine increased urine indican is common. After this period is reached there is marked constipation. The feces show nothing characteristic except the patches of mucus, in which, as well as in other tuberculous processes, the peculiar bacilli may be found. The detection of the ordinary tuberculous ulcer is not so difficult to establish because it occurs chiefly in sufferers from phthisis, and the detection of the bacilli in the mucous shreds is not difficult, but the mere presence of diarrhea must not be accepted as a proof, in these days of forced feeding of the tuberculous, when an ileocolic catarrh may be set up. The

cecal tumor, however, presents the greatest difficulty of diagnosis on account of its similarity to malignant disease and perityphlitis. Usually the age of the patient fixes it as a benign growth, but this is not absolute, and, when the pulmonary condition is so advanced that it can be readily detected, there can be no doubt. Then, again, the presence of rise of temperature or the bizarre character of the same would favor a benign tumor.

Treatment.—The treatment is both preventive and curative. The former consists of a careful inspection of the cows, as is now carried out by the Government, with occasional testing with tuberculin, so that children, who are the greatest sufferers from the primary form, may be protected in their food—milk. Sterilization of the milk is also a safeguard, which must not be neglected. Sufferers from phthisis must be especially warned never to swallow sputum, which is accomplished by the sanitaria in giving patients boxes for the deposition of the sputum. As to the various means suggested for exciting gastric juice to destroy the bacteria, should they reach the stomach, they seem to us like erecting a house of cards. It is much better to endeavor to keep the sputum out of the digestive tract. When the tuberculous process is actually established in the intestine, a diet such as recommended under Enterocolitis (page 439) may be tried, as the associated catarrh is largely the cause of the diarrhea, but milk and milk products are badly borne, and one is soon compelled to leave the patient to his own choice of food, when, strange to say, the movements are sometimes diminished in number. It is needless to state that salads should be avoided, as well as vegetables rich in cellulose, and that an occasional resort to clear soups, broths, gruels, gelatine, custards, and well-boiled rice may be necessary for a few days; but, if this does not immediately check the diarrhea, it is doing harm rather than good, for the maintenance of nutrition is an absolute need, and, as can be readily recognized, these articles are lacking in food calories on account of their volume. Rectal injections of egg, milk, and a predigested carbohydrate food do not, of course, help in checking the frequent stools, but once a day, at bed-time, given with 10 drops of laudanum, it does assist in staying the rapid loss of flesh, and has never increased the irritability of the intestine in our hands. The usual astringents—tannalbin and tannigen, bismuth subsalicylate and subgallate, as well as calcium carbonate or phosphate—will help for a time, but eventually we have to fly to the use of opium, either as suppositories of the extract, in doses of 0.02 gram ($\frac{1}{3}$ grain), or the deodorized tincture, in doses of 5–10 drops, two or three times daily. We begin, of course, with the smaller dose

and gradually increase as the occasion demands, but it is astonishing what large doses may be given without apparent harm to the patient. Colon washings with starch or gum arabic solutions, containing medicaments—dermatol, tannin, etc.—never appealed to us because no case under our observation was ever benefited by them. Surgical intervention can aid only in overcoming the stenosis and in such a way has been very beneficial; the attempt to remove an active ulcer fails to relieve the condition, because they are usually multiple, and it often spreads the disease to the neighboring areas; when, however, the ulcer has healed, then it is a different matter, and the excision of this portion of the intestine can be heartily recommended for, if the scar is at all extensive, constriction is sure to follow, and an early operation may prevent a fatal ileus when the chances of recovery from the operation are vastly lessened. The ileocecal granulation tumor should be removed as early as detected, for nothing is surer than that an obstruction will eventually occur. The rectal ulcers can be treated for a time with powders through the speculum or rectoscope, but as soon as they form fistulæ, the latter should be opened freely and curetted, an operation, sad to say, which may have to be done repeatedly, for they recur with astonishing frequency.

CHAPTER XVIII

DISEASES OF THE INTESTINAL AND MESENTERIC BLOOD VESSELS

VENOUS HYPEREMIA.

Venous hyperemia of the intestine is dependent on direct obstruction to the return flow of the blood to the heart, as in hepatic cirrhosis, or to a failure of the heart to sustain the blood pressure, as in mitral insufficiency. Extensive emphysema, too, may produce a backing up of the blood in the abdominal veins, and another most marked cause is paralysis of any portion of the intestine. At an autopsy it is not always possible to detect this hyperemia, for the blood is forced out of the veins by the contraction and rigidity of the smooth muscles. When persistent, however, the mucous membrane is bluish-red, distinctly edematous and thickened. This state does not necessarily involve the whole tract, only portions of it, but, wherever it does occur, the dilated veins will be found as well in the submucous as in the serous layers. Varices of the distended veins are extremely rare. In the stomach we recognize the fact that this stagnation of blood is the cause of catarrh, but in the intestine it is not so clear, though it may be.

Symptoms.—The symptoms, which are not always in evidence, consist chiefly of the accumulation of gas in the intestine to such an extent that the abdomen is visibly distended, and the pressure against the diaphragm holding it in a higher position than formerly checks the free movements of the heart and lungs, which add to the difficulty of maintaining the circulation. It has, furthermore, been demonstrated that the cause of this is not an increased generation of gas, but a faulty absorption. In addition, there is always a moderate amount of intestinal sluggishness, which is unaccountable, since ordinarily a faulty aeration of the blood produces diarrhea. Utilization of the food is unimpaired in mild cases, but, when severe, fat has been found in the feces and sometimes meat fibers. These events may arise from the catarrh, which may spring up from the passive hyperemia, causing diarrhea, with much mucus. These attacks are not of long duration, but extensive enough to relieve temporarily the preceding constipation.

Hemorrhage from the dilated vessels is not common, though it has been found severe enough to cause death, where autopsy showed no thrombus or embolus. Varices are common in the mucous membrane when there is no obstruction in the portal circulation, and from these fatal hemorrhages may occur.

HEMORRHOIDS.

Hemorrhoids (piles) are, primarily, only dilated veins, found about the anus, which sometimes bleed, but cause little other disturbance, and should be distinguished from the inflamed thrombosed hemorrhoidal veins which may arise from them. The former are very common; in fact, it is said that one-third of all adults, with predominance of the male sex, possess them. Children are rarely afflicted, but sometimes an instance is found. The sphincter divides these into external, which can be readily seen, and internal, which can be observed only through a speculum, though they can often be felt. The internal ones are always in close vicinity of the sphincter, and never cover the circumference of the rectum, but are apt to be grouped on one side as bluish-red slight eminences, and, if true varices, are soft and not unlike those dilated veins found in the leg or the scrotum, so that, unless inflamed, we cannot speak of them as nodules. Often thrombi form in them, and more or less interstitial tissue is produced by inflammation, when they appear as hardened, somewhat tender, nodules, which can be readily distinguished by sight or touch from the surrounding tissue. As to causation, our views are changing, and we no longer hold cirrhosis of the liver or cardiac insufficiency as responsible for more than a minute portion of them; in fact, the former are oftener only an accompaniment. The true obstruction is more local, as in pregnancy, during which at least one-third of all women acquire hemorrhoids, which may disappear or persist after its termination. Next to this cause, constipation probably produces more examples than any other, but we must differentiate between that form with rectum packed with feces, where pressure plays a part, and that variety where the delay is higher up and the terminal of the great intestine is always found empty. In the latter, straining at stool is unquestionably the chief factor, acting on weakened veins. Among the lesser causes are enlarged prostate in men, retroverted uterus in women, tumors of the rectum or ovaries, or inflammatory attacks of these parts, and occasionally cystitis. Rarely do hemorrhoids exist for any length of time without becoming inflamed from thrombus formation, the cause of

which is the entrance of microorganisms from the fecal matter, the use of improper closet paper, and the onset of eczema with scratching. Whatever the cause may be, a small painful nodule is formed, which after a time subsides, leaving a pendulous mass of connective tissue, sometimes termed a "tab." When this is outside the sphincter, it causes no further difficulty, but, if inside, it is often the starting point of a polypus, which at removal often requires a microscopic examination to determine whether it is malignant; pedunculated at first, it may become adherent to the interior of the intestine almost throughout its whole length.

Symptoms.—The symptoms of the uncomplicated hemorrhoids are often so insignificant that the patient's attention is first called to them by the presence of blood in the stool. Still, in an earlier period there may be itching and burning about the anus, usually associated with constipation, to which may be attributed usually the sense of fullness in the anal region, the confusion of the thoughts, and the inability to apply oneself to mental efforts. The bleeding at first is only minimal—a smear on the closet paper and only at stool; later it becomes more excessive, and may be found on coughing or sneezing, and exaggerated after intemperate eating or drinking of alcoholic beverages or after a long railroad journey. The blood is always smeared over the stool, if formed—never mixed with it. If small fecal particles are present (colon spasm), they may be found swimming in a small pool of blood. The blood is usually pure, bright-red or dark-red, never brown (hematin), and is unmixed with products of inflammation (mucus and pus) unless a proctitis is associated. Occasionally the patient, if full-blooded, feels relief after a discharge of blood with the stool, but oftener the sufferers are blanched from the repeated loss of blood. Invariably with the history of bleeding from the anus, that region must be inspected, and often bluish distended veins may be seen, interspersed with the so-called "tabs" or remnants of inflammation of the hemorrhoids, while occasionally these can be seen to protrude through the anus, particularly when the patient strains. If not seen at once, the rectoscope should be used, when they are readily discerned within the sphincter.

The simple inflammation of the hemorrhoids usually affects only the external and possibly intermediate veins. The patient feels a sense of heat and pressure at the anus, an unusual desire for defecation, and pain during this act. The patient himself, on touching the part, discovers a small tender spot and makes his own diagnosis. The physician finds at this time slight hardening and some tenderness over

the vein, but this is not the true nodule of thrombus formation; this milder form may disappear and recur several times. When, however, thrombi form, accompanied by phlebitis, then the attack is more severe, and a nodule is formed which is extremely painful, so that the passage of feces or flatus causes exquisite torture. The patient is conscious of a foreign body in the anal region, which he tries to remove by straining at stool, and the desire for defecation is constant; there is also throbbing of the parts. Sitting is painful, strangury is sometimes present, and there may be a slight rise in temperature. This condition may continue a week, and after it has passed away there is only an empty sack left to show its site. A still more serious complication is the protrusion of the hemorrhoids through the anus at defecation, or often by sneezing or coughing. For a time these can be replaced, but there comes a period when their base is so compressed by the cramp of the sphincter that strangulation takes place. These strangulated hemorrhoids become very edematous, the dark-red color changes to an ashen hue, they discharge a blood-stained fluid, and there may be complete gangrene. Often, however, the thrombus organizes, leaving the "tab" of connective tissue. These strangulated piles increase all the difficulties spoken of before, and, if suppuration follows, we may have a decided rise of temperature, and, unless opened, the pus may burrow into the perirectal tissue and form an abscess which usually breaks outward. These attacks of inflammation are soon over, but others occur unless the patient is exceedingly careful (cleanliness of parts and regulated movements), and a real hemorrhoidal status is set up in certain individuals. When once inflamed, however, that hemorrhoid "ceases from troubling" and the hemorrhage always comes from the uninflamed varices. The excrescences, remnants of former hemorrhoids, do no harm except to retain fragments of feces and thereby incite infection in fresh varices. Finally, after years of progressive activity and quiescence, when the anus is surrounded by a rosette of hemorrhoidal remnants, the process may cease and no more discomfort be suffered.

The differentiation of these hemorrhoids from polypi and condylomata is not difficult when exterior; when intermediate, they can be forced out of the anus usually by bearing down, particularly after an enema. From beginning rectal carcinoma in the elderly the distinction is not so easy, and one should never be satisfied without an examination with the use of the rectoscope.

Treatment.—The treatment of hemorrhoids should comprise, first, the removal of the most frequent cause, constipation, by the diet given

on page 416. Furthermore, all condiments and alcohol should be forbidden, and the patient should be warned against too vigorous bearing down at stool. Strong purgatives must not be employed, but an excellent remedy is the old sulphur and cream of tartar mixture, which can be improvised as follows:

R Sulphuris loti 6.0 or 1½ drams
 Potassii bitratratis 20.0 or 2½ ounce
 M. Fac in chartulas vel tabletas XX.
 Sig.: Two or three at bedtime.

When these fail, we may use pulvis glycerrhizæ compositus, fluid-extractum rhamni purshianæ, or tamarinden.

The use of enemata should be forbidden, particularly with hard rubber tips, though the soft rubber rectal tube, well lubricated and skillfully introduced, never seems to do any harm. On account of the possibility, too, of irritation, glycerine injections or suppositories must never be employed. When the hemorrhoids are prolapsed, long railroad journeys and horseback and bicycle riding should be forbidden. After the act of defecation, the anus should be cleaned with the softest of closet paper, dipped in 4 per cent boracic acid solution, and after it is dried the piles should be well smeared with olive oil, and an effort made to push them through the anal ring with a small wedge of absorbent cotton if they have become protruded during defecation.

The complications demand their appropriate means of treatment. Irritation, as manifested by stinging and smarting, can be controlled by a suppository containing anesthesin 0.2 gram (3 grains). Chrysarobin, in conjunction with iodoform, may be used in a suppository, as follows:

R Iodoformi 0.6 or 10 grains
 Chrysarobini 1.2 or 20 grains
 Extracti belladonnæ 0.4 or 6 grains
 Olei theobromatis q.s.
 M. Fac suppositoria rectalia XX.
 Sig.: Insert one at bedtime.

For the clinic, where the cost of suppositories is objectionable, we may employ the following salve, which should be smeared on small pledges of absorbent cotton and inserted into the anus after the stool and preliminary cleansing process:

R Pulveris gallæ,
 Pulveris opii,
 Plumbi acetatis, &c 1.0 or 15 grains

Lanolini,
 Petrolati, M. 15.0 or $\frac{1}{2}$ ounce
 M. Sig.: Smear on cotton and insert after cleansing parts.

Bleeding sometimes demands the most energetic treatment, particularly when the patient begins to be blanched. Small injections of ice water through a double-current catheter are often sufficient, while internally one gives the following:

B Fluidextracti hamamelidis foliorum,
 Fluidextracti hydrastis, aa. 30.0 or 1 ounce
 M. Sig.: Teaspoonful in water three times daily.

Boas recommends the introduction of 20 c.c. of 10 per cent watery solution of calcium chloride, with a soft rubber bulb syringe, after the stool. Adrenalin suppositories may also succeed in checking the bleeding. When the oozing does not cease from these means, it is wiser to

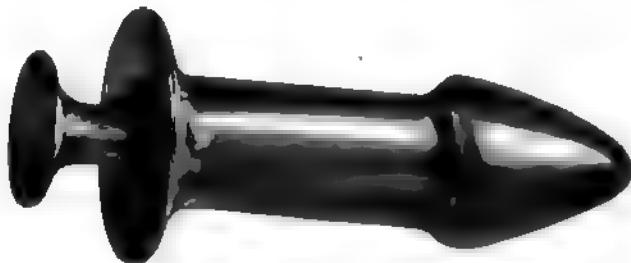


Fig. 83.—Rectal pessary.

introduce a rectoscope or speculum and pack firmly with iodoform gauze, or cauterize the bleeding varix.

When the hemorrhoids become inflamed, it is absolutely necessary to place the patient in bed, with the foot raised, and a suppository of extractum opii or extractum belladonnae should be introduced, or a combination of both, while ice should be applied to the affected part. When the ice is badly borne, we may employ poultices of cataplasma kaolini, N. F. When the inflamed hemorrhoids show a tendency to suppuration, local anesthesia should be produced by cocaine or quinine and urea, the nodule laid open, the clot removed, and a stitch inserted; in two days the patient can get out of bed, on the fourth a laxative may be taken, and on the sixth the stitch removed (Zweig). When the hemorrhoids are protruded through the anus and only moderately edematous and inflamed, an attempt should be made with the finger, armed with a rubber cot and well oiled, to restore them, which can be aided by first painting them with a 5 per cent cocaine solution. No

unnecessary force should be used, and it may take fifteen minutes of the most careful effort, much as one proceeds with an incarcerated hernia, before success crowns our efforts; if, at last, they are returned, a pledget of cotton should be introduced and a T-bandage applied, or a rectal pessary may be used. The latter is much more effective, but the patient complains often of discomfort from its presence. When, however, the strangulation has proceeded to the point of beginning gangrene, no further efforts at reposition should be made, and we can only assume an expectant attitude, with morphine suppositories to control the pain, and wait for the time of demarcation and sloughing of the necrosed portion.

In résumé we may say that three conditions arise when surgical intervention is necessary: (1) when repeated bleeding causes anemia, (2) when there is constant protrusion of the internal variety through the anus, (3) where the varices become repeatedly inflamed. Two methods of surgical procedure have been described under Proctitis, page 479—The one, actual cautery, requiring all the paraphernalia of an operating room, with the use of ether; the other, phenol-glycerine injection, performed by the physician in his office. A third method, now less popular, is ligature at the base of the nodules, which appears the least commendable of all, though imitating nature's method of cure, when strangulation has sometimes been accompanied by tetanus.

ARTERIOSCLEROSIS.

Arteriosclerosis of the intestinal arteries is a disease which attacks chiefly those beyond 50 years of age, and more males than females, though Buch reports cases as young as 26 and 29 years of age when the process was of syphilitic origin. Besides lues, which plays the most important part in causation, alcohol, plumbism, and the excessive use of tobacco have been accused. The vessel most often attacked is the abdominal aorta, which may be broadened or lengthened and made more movable, or it may assume a new position. This hardening of the abdominal aorta may exist apart from that of the thoracic aorta or of the mesenteric arteries. When, however, the latter are sclerosed, the abdominal aorta usually participates. While this process produces enlargement of the aorta, the mesenteric arteries are narrowed, particularly where they leave the former. A part of the symptoms is due to spasm of the arteries, for Pal saw the blood pressure rise from its usual 90–100 mm. to 170–220 mm. during an attack and as rapidly diminish to its former height afterward. It can be readily

seen that these sclerosed portions in the narrowed mesenteric arteries furnish the most favorable conditions for the formation of thrombi (damaged intima and slowing of the blood current). Buch recognizes three forms—one, idiopathic, or at least existing alone; another, associated with contracted kidney; and the third, in conjunction with thoracic aortitis and true angina pectoris.

Symptoms.—The symptoms are fairly regular in their nature, and consist of attacks of abdominal pain, paroxysmal in character, located usually above the navel in the median line and extending upward toward the costal borders. The pain may be either burning or stabbing, or, as some say, indescribable. The duration is from a few minutes to half an hour, and its greatest peculiarity is its frequency, occurring often several times a day, but not at all constant. Food has nothing to do with the onset of the attack, but it is brought on by exercise, particularly raising a heavy object from the ground or ascending stairs. A horizontal position may cause the onset in some, while in others the emotions (anger) are held responsible. Cardiac asthma and cyanosis rarely accompany the epigastric pain. Other signs of arteriosclerosis may be found in the rigid radials and temporals and a hypertrophied heart but lack of compensation of the last is never present. As a result, too, the second aortic sound is found accentuated.

Physical examination may not always show an enlarged or movable abdominal aorta, but it is always tender, and this tenderness may be elicited by pressing on either side of the aorta or over the vertebræ. This pressure point is also situated exactly where the spontaneous pain arises. As can be readily seen, the attacks are very similar, except in the location of the pain, to those of angina pectoris, from which it is often difficult to disassociate them, and, in fact, with which they may exist in unison. The digestive tract is rarely involved, yet there may be vomiting with the pain, and the patients are usually mildly constipated. When there is a conjoint arteriosclerosis of the brain, we may have giddiness, headache, and failing memory, which will aid in the explanation of the abdominal pain. Hemorrhages, too, may occur, as evinced by tarry stools; in fact, are claimed by some to precede the onset of the disease.

Diagnosis.—When severe pain in elderly people occurs spasmodically, we must think, of course, of malignant disease, but those who suffer from abdominal aortitis are often in the best of physical condition, with ruddy cheeks, and, apart from an occasional gaseous distention of certain parts of the intestinal tract during the pain,

show no signs of stenosis. True, the visible pulsating aorta may be due to a growth lying over it, but in that case the aorta cannot be freely palpated and its anomalies of position and size detected as it can be in aortitis. With *gastralgia* (ulcer?) and *pseudoangina* these attacks have much similarity, but the former come in younger individuals, possibly in women during the climacteric, while these occur almost invariably in elderly men. The few exceptions where young adults are affected show such marked manifestations of general arteriosclerosis from syphilis (contracted kidney, hypertrophied heart, etc.) that mistake is impossible. The onset of pain, too, in *pseudoangina* usually occurs after a meal, induced perhaps by rapid eating, awakens the patient from a sound sleep, or occurs in the early morning, but never after violent exercise, which is peculiar to abdominal angina as well as, of course, to the thoracic form. Furthermore, the beneficial effect of *diuretin* and *strophanthus* confirms the diagnosis.

Treatment.—The treatment consists, first, in placing the patient in bed. If the attacks are frequent and if the full prone position aggravates them, as sometimes happens, the bed may be made up in a Morris chair, or a head-rest may be placed in the bed, so that the sufferer will be half seated. The application of the electric pad or thermophore to the abdomen stills the pain and helps to prevent recurrence. Where the patient is obese and the heart and aorta are sound, moderate exercise in a gymnasium will often prevent the return of the pain. In conjunction with the gymnastics, abdominal massage should be employed, which has been proven to relieve the increased blood pressure, and therefore allows less incitement for a spasm of the abdominal aorta. The diet seems to be unimportant in controlling the attacks, but alcohol and more than the most moderate use of tobacco should be forbidden.

Medicinal treatment is confined to a few drugs, of which *diuretin* (theobromin-sodium salicylate) may be given in doses of 0.5 gram (8 grains) three or four times daily, well crushed, if in tablet form, before swallowed, or in the following form:

R	Diuretini	6.0 or 1½ drams
	Aquaæ destillatæ	50.0 or 1½ ounces
	Aquaæ menthæ piperitæ, q.s. ad	240.0 or 8 ounces
M. Sig.:	Tablespoonful three times daily.	

The most remarkable relief from pain which comes after the use of *diuretin* can be accomplished only by its checking arteriospasm. *Tinctura strophanthi* also has the same favorable influence as a pre-

ventive of spasm, and should be used in doses of 4-8 drops three times daily, beginning with the smaller amount and increasing according to the needs of the patient. Iodine also has proved its worth in checking attacks of pain and lowering blood pressure. Whether we use the sodium or potassium iodide in half-gram doses three times daily, or the newer and, of course, more expensive sajodin, in similar doses, supplied in tubes of twenty, is indifferent except to the palate and the purse, for the latter is undoubtedly more easily taken and less liable to produce iodism. The acute attack itself is of so short duration that the physician can rarely reach his patient before it is over, but, if he does arrive, an injection of morphine is practically the only thing which will check the spasm. If much weakness of the heart be present and the subsequent depressing effect of morphine on that organ be feared, a second injection of camphor may be given, for which purpose manufacturers provide very convenient ampules containing one dose. The tablets of glonooin (nitroglycerin), containing 0.0006 ($\frac{1}{100}$ grain), or pearls of amyl nitrite, 0.3 gram (5 minims), may be left with the patient to be taken, or the latter crushed and inhaled at the beginning of the attack, but they are not nearly as effective as in angina pectoris.

EMBOLISM AND THROMBOSIS.

Embolism and thrombosis of the mesenteric arteries are not common occurrences, but, when they do take place, cause the greatest difficulty in diagnosis unless their possible advent is recognized. The most common causes of embolism and the more frequent thrombosis are endocarditis, an atheromatous aorta, or the formation of a clot in the pulmonary veins. Both mesenteries may be occluded by a clot at the same time, but a search through the literature shows that the superior is more commonly affected. If the clot is large and lodges near the aorta, the entire portion supplied with blood will be affected; if in the superior, the horizontal portion of the duodenum, the rest of the small intestine, the cecum, and the ascending and transverse colon may be involved in the cutting off of the supply of blood; if in the inferior mesenteric, the descending colon and sigmoid will be deprived of their blood supply. The results are either a bloody infarct of this portion or portions of the intestine if there is some return of blood through the veins—i.e., the occlusion is not complete—or anemic infarct and gangrene when there is no return flow—i.e., if it is complete. The latter may sometimes take place when the veins are likewise blocked by thrombi. This has been experimentally demonstrated on dogs, in

which, when complete closure of the mesentery is produced, anemic infarct occurs, and, when incomplete, hemorrhagic. Sievers reports the autopsy of a woman of 56 years who lived twenty-nine hours after the accident, at which an embolus 6 cm. long was found in the superior mesenteric, only a short distance from the aorta, and from 1 meter below the pylorus to 7 cm. below the ileocecal valve the intestine was found red, swollen, and filled with brownish-red semifluid contents; the duodenum, upper part of the jejunum, and descending colon were perfectly normal. The intestine does not necessarily become gangrenous from either the hemorrhagic or the anemic infarct, and, after circulation is restored, may emerge unharmed, as pathologists have shown us. Usually, however, that portion of the intestine suffers more or less damage. If the emboli are smaller, they may occlude the smaller divisions of the mesentery, producing localized infarcts, as in a case of ours, where at autopsy about 30 cm. of ileum were found of a burgundy wine color and extremely thickened, and one reported by Lambert, where several feet of the small intestines were thus affected by multiple emboli in the smaller mesenteric arteries. When circulation is restored in such circumscribed portions of the intestine, healing may take place with the formation of a stricture, or, if the emboli reach the capillaries, ulcers may result. When thrombosis takes place, it is due to arteriosclerotic changes in the arteries as a result of syphilis; if the occlusion is complete, the same changes occur in the intestine as in embolism, but, as the obstruction is gradual, the changes take place more slowly and the symptoms of abdominal angina precede. Thrombosis of the veins is much more common than of the arteries, and proceeds from the portal vein, due oftenest to empyema of the gallbladder or from infection arising in the intestine and taken up by the smaller veins. The result on the intestine (hemorrhagic infarct) is the same as in partial occlusion of the artery.

Symptoms.—The symptoms always come suddenly, usually without any warning. In our own case they followed some weeks after an attack of cholelithiasis in a woman of 60, and began in the night with such severity that an ileus was diagnosed. Rarely there may be prodromal symptoms for weeks or even months where a thrombus forms, consisting chiefly of abdominal pain. Two types of the disease are generally recognized, though they may be similar in certain features. Both forms are noted for severe sudden abdominal pain, which is first localized in the epigastrium, but finally streams over the whole abdomen, accompanied by vomiting, cool extremities, small rapid pulse, and subnormal temperature, accepted by all as indicating shock. The

only departure from this picture is the occasional absence of severe pain. From this point, however, the ways separate. The first type is accompanied by abundant tarry stools, or, as Lohr reports, by hematemesis; usually one bloody stool is passed, but often a veritable diarrhea follows, with copious blood. After this the pain subsides somewhat until the abdomen begins to distend, and we have diffused tenderness and rigidity—in short, the evidences of a peritonitis. The other form has all the distinguishing marks of an ileus and is usually mistaken for it; the pain is continuous, the state of collapse is more marked, and no passage of stool or gas takes place. At first there is subnormal temperature, and later there may be a slight rise; vomiting may continue until finally it is of a fecal character, as in Lambert's case. There is moderately diffused distention and abdominal tenderness, but no movement of the intestine can be seen or felt (absence of rigidity), nor is gurgling heard, as in true stenosis. If the patient survive the original shock, peritoneal involvement may arise later. There is not the slightest question that complete paralysis of the section of the intestine involved takes place. Death, if operation is not performed at once, occurs early; in Siever's case in twenty-nine hours; in our own, death occurred at the end of twelve days, during which period there was almost constant vomiting and no stool passed, but the peritoneum was not involved at autopsy—only a partial or gradually increasing occlusion can account for this. The difficulty of diagnosis is shown when we learn that, out of 96 cases reported by Newmann, only 18 were diagnosed during life; in fact, where no hemorrhage occurs, it is practically impossible to distinguish this condition from ileus caused by other agencies.

Treatment.—The treatment is only surgical, and the removal of the infarcted portion of the intestine should be performed just as early as possible and before the peritoneal complication takes place. It is not necessary to wait for an absolute diagnosis, either tarry stools or evidences of acute ileus are present, and an exploratory operation should take place at once. The early removal of the paralyzed portion of the intestine has been successfully performed several times, and there can be no argument for delay in such a fatal disease as this. When operation is refused or a surgeon is not available, all we can do is to relieve the pain by the hypodermic use of morphia, and, if the case is at all prolonged, feed by the rectum on account of the constant vomiting.

CHAPTER XIX

INTESTINAL STENOSES AND OCCLUSIONS

These terms strictly mean different degrees of the same division, the first referring to a partial closure of the lumen of the intestine, and the latter a complete one. The results, too, of the former may differ markedly, whether the narrowing is in the small intestine, where the liquid fecal contents often allow a long period to elapse without symptoms, or in the lower part of the large intestine, where their solid character very soon produces manifestations in the form of alternating diarrhea and constipation, colicky attacks, which may last for hours with intermissions, but with steadily increasing difficulty as the passage becomes narrower, and more or less extensive meteorism, in accordance with the site of the narrowing. The total obstruction, when neither feces nor gas can pass, may be gradual or sudden as in intussusception at the ileocecal valve or twists at the sigmoid. In the latter case, vomiting is persistent until it becomes fecal. When the obstruction is of slow growth, the portion of the intestine before it becomes hypertrophied in its efforts to force the contents forward, and also in time becomes dilated, like a heart when the process of hypertrophy has reached its limit and the obstruction remains the same; soon, also, there is an enteritis set up by the fermentation or putrefaction of the stagnating contents, whether in the small or large intestine, in that part lying before the stenosis; minute ulcers, too, are not uncommon in this area, supposed to be due to the toxins produced by bacteria.

STENOSES.

The causes of these strictures are scars from ulcerative colitis, tuberculosis, typhoid, the results of inflammation after reposition of incarcerated herniae, bands produced by localized peritonitis (in one instance in our experience extending from the cecum to the sigmoid), malignant new growth and pressure from adjacent tumors (as in one case seen by us), malignant disease of the uterus, which compressed the sigmoid without its being involved in the process.

Symptoms.—The symptoms rarely follow a well-defined course. In

some patients change in the regularity and consistence of the stools, where previously the function has been as systematic as the interchange of day and night, is most prominent; in some, spasmodic pains, and in others the meteorism. When we consider that the intestine, with its enormous length and constantly changing content, offers four to five favorite sites for narrowing, such variations could only be expected. One fact is true, however—wherever the stenosis may be situated, the symptoms are progressive in severity, though, as stated, narrowing may exist in the small intestine a long time before symptoms are distinctive. As to the movements, when the site is in the small intestine, constipation does not occur; the stools are liquid, of very offensive odor, and contain much mucus, while they may be mixed with blood and pus, which does not necessarily indicate destruction of tissue. When the narrowing is at the ileocecal valve or anywhere between that point and the hepatic flexure, we have the same tendency to occasional attacks of diarrhea, but rarely constipation unless that had existed for many years. On the contrary, when the stenosis is between the hepatic flexure and the terminus of the tract, restricted movements are the rule, but a woman under our observation, on whom a resection of the descending colon for an annular carcinoma at the level of the crest of the ilium was performed, had numerous loose stools, which were sometimes mixed with blood. More attention should be paid to the quantity than the frequency of the movements, for often the desire is constantly present, and the patient goes frequently to stool, but passes only a trifle. A peculiarity of the feces, which undoubtedly enables them to pass the narrowed portion of the canal, is the ability of the scybala to induce transudation from the mucous membrane and become softened on the outside as well as covered with mucus. The peculiar shapes—ribbon, lead pencil, etc.—have no significance as a mark of permanent stenosis, since they can be produced equally as well by spasm. Briefly, then, narrowing in the small intestine causes occasional diarrhea in conjunction with normal stool. Narrowing in the caliber of the large intestine is accompanied by constipation, with occasional periodic attacks of frequent, scanty discharges of foul-smelling, liquid fecal matter. The pain shows many characteristic features. It may have no relation to food, or may come quite regularly three to four hours after it is taken, and is aggravated by food containing much cellulose, like lettuce, cabbage, coarse bread, nuts, etc. It begins suddenly, soon reaches its maximum, during which the patient often holds his breath and presses with both hands over its site. Cold sweats may break out on his brow, and in a quarter to a half minute it is over, accompanied

by a loud gurgling sound, but this relief is only momentary, and it returns with almost the regularity of labor pains, at short intervals, during that attack, and then, exhausted, the sufferer may be free from discomfort for a portion of the day and perhaps until the next day, for the attacks are not equally distributed over the twenty-four hours. During these periods of pain no gas or feces are passed, but after the painful attack they are passed freely, to which the patient always ascribes his relief. Vomiting may occur at the height of the pain, but it is purely reflex and has nothing to do with the fecal vomiting of acute complete obstruction. The site of the narrowing can be easily ascertained by the location of the pain in its less acute paroxysms, for during the height of an attack it streams everywhere. Vagaries in this respect may occur, however, for in an elderly man, with narrowing in the sigmoid—as could be easily seen from the end of the wave of contraction and as proven by operation—the pain was always referred to, in his words as in the "pit of the stomach." Usually the pain is severer the narrower the constriction becomes and the more vigorous the visible peristalsis (rigidity). The visible and palpable contractions of the intestine above the constriction are also very characteristic. As the patient lies in bed, the abdomen may appear perfectly normal, but soon in some portion a wave begins, by which a portion of the gut becomes raised and visible, much as a fire hose when the engine is started. This elevation of the hypertrophied portion of the gut, particularly in thin-walled individuals, increases until it is plainly visible, or in thick-walled is palpable as a round well-filled tube, whose distal terminus is the stenosed portion. Such an appearance may be simulated by lead colic, the exaggerated physiological contractions (*tormina intestinorum*), or by the spasm of membranous colitis, but in all these cases the portion before the constriction is soft, elastic, or filled with gas, but never with a large amount of fluid. At the close of the rigidity, and just before the complete relaxation, one can always hear the gurgling, which indicates the passage of fluid matter and gas from a higher well-filled to an empty lower portion of the intestine, but not necessarily through the narrowed contracted section, for the sound is heard above this point. After each period of rigidity there comes a desire for stool, which cannot always be gratified. As these rigid portions occur only in the hypertrophied section of the intestine, much can be learned as to the site of the stricture after they become well established. If at the rectum, the sigmoid will be found to undergo these changes; if at the sigmoid, the descending colon and possibly the transverse and ascending, so that a horseshoe

appearance is presented, with the straight portions in the flanks. The great size, apart from the position, excludes confusion with the small intestine. When the constriction is at the ileocecal valve, the rigidity occurs in the middle of the abdomen, often in parallel layers, which never takes place from a colon narrowing unless there is an insufficient valve. Often in colon constriction, as well as those of the duodenum or jejunum, the waves imitate closely those of the stomach, except that they run from right to left, while those of the stomach proceed from left to right. After the spasm is over, there still remains in the hypertrophied portion of the intestine before the stenosis a small accumulation of gas, which will indicate where the rigidity occurred, but oftener the coil of intestine sinks below the surface of the abdomen until the next contraction. On percussion, these inflated coils afford a loud tympanitic note, which during the spasm becomes flat because the gas is largely driven out of this portion of the intestine; if deep (colon), the note may be absolutely flat in the flanks and changes with the position of the patient, much as in accumulation of fluid in the abdomen, but we always have the spurting and gurgling sounds to guide us. The latter may also occur before rigidity establishes the presence of a stenosis, but are not to be relied on, because they may occur in functional spasmodic contractions of the intestine, but never at the same point for any length of time. The only general condition common to chronic stenosis of the intestine is an increasing anemia and emaciation, which is probably due to the intestinal catarrh and waste of food elements. Indican of the urine is rarely affected in colon constrictions, but is markedly increased in those of the small intestine.

Clinical Picture.—The clinical picture changes in accordance with the site of the obstruction and its completeness. If the duodenum above the papilla of Vater is constricted, we cannot distinguish the condition, unless the x-ray examination aids us, from ordinary pyloric obstruction; if below this point, however, while we have the same symptoms of epigastric pressure, eructations, and vomiting, the vomitus, washings of the fasting stomach, and gastric contents after the test breakfast all contain bile. Furthermore, the results of the examination of gastric contents show varying conditions as to acidity. In one case of ours, with the constriction below the papilla, found at operation, they changed from no free hydrochloric at one time to acidities of 25 and 63 at another; there was moderate stasis, and our history of the above case mentions the finding of lactic acid and thread bacilli. The bowels are usually confined, with occasional attacks of diarrhea; the urine is much diminished and generally contains an increased

amount of indican, while in the case quoted there was always a distinct trace of bile pigment as well; the stools contain ample stercobilin until the stenosis becomes complete, and then they become clayey.

The narrowing of the jejunum or ileum, even at the ileocecal valve, has symptoms much alike—rigidity and prominence at about or above the navel in the center, while the flanks remain flattened. There is often a long latent period when only at a certain point or points—if the stenoses are multiple, as sometimes happens—the gushes can be heard and felt, but there is no marked pain other than a sense of discomfort, and no rigidity occurs. If this group of symptoms is accompanied by diarrhea, with more or less mucus and increasing anemia, the constriction of some part of the small intestine is probable, which often surprises us with a sudden attack of complete obstruction, accompanied by constant vomiting and prompt hydrobilirubin reaction in the vomitus. Then the meteorism so far predominates over the rigidity that the latter is not noticeable.

Stenosis at the middle of the transverse colon or before does not cause the restricted enlargement of the right flank, which would be expected on account of the weakening and lack of resistance of the ileocecal valve, so that the protrusion extends well into the middle of the abdomen. The succussion of the cecum is marked, but alone cannot be taken as diagnostic of stenosis, for in typhlatony slopping can be elicited, where there is no possibility of organic constriction. The hepatic flexure never becomes sufficiently distended to be visible, the movements are variable, diarrhea and persistent constipation alternating, or the latter may prevail, and indican is usually unaffected, though it may be markedly diminished. When the stricture is situated low down in the tract, the rigidity may affect the whole colon, the descending portion and sigmoid, or the sigmoid alone, when there are sharp turns between that and the ascending colon. Here, too, the lax fixation of the sigmoid may produce many mistakes in diagnosis. The form of the stools may be ribbon- or lead-pencil-shape, or may form the usual cylinder below the narrowing. If the stools are solid before they reach the constriction, there is less liability that marked meteorism will be found, because gas passes better under such conditions than when mixed with fluid contents. The indican is unaffected.

The duration will depend largely on the extent and continuance of the hypertrophy of the gut above the narrowed portion. It will persist much longer in the young than in the old, but, when dilatation occurs, then the symptoms of ileus (complete closure) follow. In the small intestine repeated attacks of ileus may occur and the patient

overcome them without operation, but in the colon this is rare. In the small intestine, too, one rarely can tell whether a sudden closure of the lumen is really an acute affair or the outcome of a latent chronic stenosis brought on by indigested food, associated spasm, or sudden increase of the narrowing, caused by overdistention of the intestine with gas. Restitution to normal condition is one of the rarities of medicine, and the narrowing continues, with temporary or remittent obstruction, or, as stated, pursues a latent course until sudden and complete occlusion occurs, one of the most ominous accidents with which the profession has to deal.

OCCLUSION.

Here there is a vast difference, both in the pathologic conditions and symptoms, whether the obstruction is actually acute as well as sudden, or whether it is the outcome of a long continued previous narrowing of the intestine. Furthermore, if the blood supply is wholly or partially shut off, a new feature, strangulation, is introduced. If acute, the intestine above the obstruction is full and tense, while that portion below is collapsed and empty. If the obstruction is low down and the ileocecal valve holds, only the colon is involved; if not, the distention can be traced beyond the valve; if the obstruction is in the small intestine, the distended coils can be followed to the stomach. At autopsy the walls of the canal are always found thinned and well injected with distended arteries. When, however, the total obstruction follows the partial, the enlargement of the intestine is much greater, for in this case it has wholly lost its contractility. When strangulation takes place, we have a double feature presented—the closure of the lumen of the gut and restriction of the blood supply by pinching some of the mesenteric vessels, either arterial or venous, the result being the same; hence, in addition to the dilatation of the intestine above the constriction, we have a leakage of blood into the lumen of the canal and true hemorrhagic infarct. There follows soon a gangrenous condition of the pinched intestine, beginning at the point of greatest pressure, allowing bacteria free ingress to the peritoneal cavity, and resulting only too often, unless surgical relief is secured at once, in fatal peritonitis. As soon as the complete closure occurs, peristalsis in parts below the point ceases, while above it is exaggerated, so that fecal contents from distant parts are hurried to the constricted section, and there is also above an excessive intestinal secretion, both of which account for the large amount of fluid. When strangulation occurs, gas absorption is very much impaired, as it always is where the circulation

is slowed, fermentation continues rapidly, and the meteorism increases in proportion. How much of this is due to excretion of carbon dioxide from the blood, if any, is not known. The causes, apart from those mentioned for stenosis situated in the walls or outside, may be inside, such as gallstones, which are more apt to obstruct the duodenum and jejunum, or enteroliths, huge concretions of lime or magnesium, with more or less plant residue, whose favorite site is in the lower colon.

STRANGULATION.

Strangulation is due to many causes, such as peritoneal bands; an orifice produced by the adhesion of the tip of the appendix to the abdominal wall, through which a coil of the intestine slips and is pinched; narrow slits from peritoneal adhesion in the omentum or mesentery, which arise from injury or laparotomy, through which the same occurrence takes place. Here, too, are found the various herniae at the inguinal and femoral canals, through the diaphragm as well as through the rectal and vaginal wall.

INVAGINATION.

Invagination, by which a superior portion of the intestine slips within an inferior like a sheath, is usually accompanied by moderate, if not complete, strangulation, as evinced by the rapid onset of bloody discharges soon after the event and the occasional necroses and discharge per anum of the invaginated portion. In this form the occlusion may not be complete, but, on account of the subsequent edema, narrowing of the lumen is more marked, and from the pressure on the mesenteric vessels the symptoms simulate those of occlusion rather than stenosis in their suddenness and severity. The favorite sites are the ileocecal orifice and the sigmoid. The former is most common, forming 70 per cent in children, who are the chief sufferers from this form of obstruction, under 1 year of age and at least half of those over 1 year old who suffer from obstruction.

Volvulus, or a twist of a portion of the intestine, together with its mesentery on its axis, which usually coincides with the former, also produces all the symptoms of strangulation. The most common site of this is in the sigmoid and cecum, where this circular motion is favored by too long a mesentery.

Symptoms.—The symptoms of occlusion and strangulation may be considered together because they differ only in degree.

Occlusion is distinguished by complete cessation of stool and passage of gas—stoppage, as it is commonly termed among the laity—and may be sudden or gradual in its onset. The fecal fragments, which are sometimes washed out by enemata, lead to our self-deception, for they are from the ampulla as well as the air which escapes after the injection, as it is probably introduced with the fluid. The colicky attacks soon follow, and, if accompanied by powerful peristalsis with rigidity we may conclude it is not an absolutely acute affair, but has been preceded by partial obstruction. When, on the contrary, there are no energetic contractions, accompanied by hardening of the section of intestine above, we may be assured that the obstruction is really acute. Still, in individuals with thin abdominal walls the intestines can be seen to be in a state of active motion, but this is in no degree comparable to the powerful spasmodic contraction of a hypertrophied section, which can be seen above the level and distinctly felt. These tumultuous movements of the intestine in absolutely acute cases soon cease, as it becomes paralyzed and the pain subsides with them. The meteorism may be lacking at first, since the blood supply is not impaired, but later, from the increasing distention of the portion before the occlusion, absorption of the gases is hindered and distention occurs. Gurgling and spurting sounds may be heard at first, even where no stenosis exists (bands and omental openings), but are not so loud, and soon cease; the percussion and auscultatory findings (metallic flat tones) are even more pronounced than in stenosis. The vomiting, an almost constant concomitant of complete closure, does not come on at once, but follows, after a short period of loss of appetite, eructation of bad-smelling gases and nausea, within twenty-four hours, or at least not later than forty-eight hours, unless the occlusion is seated low down in the tract and gradual, when five days may elapse before the vomiting. At first the contents of the stomach are ejected, and then, as one's nose or the Ehrlich test for sterobilin applied to some of the vomitus will inform us, the fecal matter is being thrown up. This is the last act in the tragedy, and is always indicative of complete closure of the lumen, if any doubt existed before. With the onset of fecal vomiting the condition of the patient becomes distinctly worse, and then resembles closely that of strangulation, but occurs much later. The eyes are sunken, the pulse rapid and weak, the hands and feet cold and blue, the temperature is subnormal, and, suffering intensely from thirst, the victim dies in collapse, usually in full possession of his senses. When occlusion of the small intestine takes place, the vomiting is earlier,

more persistent, and the vomitus often fails to give the stercobilin reaction.

Strangulation is particularly noted for the violence of its onset, which usually attacks persons in perfect health. The colicky pains become severe at once, are continuous, localized about the navel, and do not undergo remissions. The evidences of shock, which in simple occlusion come on later, here appear immediately; the face expresses great anxiety and suffering, the pulse is rapid and weak, the temperature sinks below normal, and the extremities are like ice. The vomiting at first consists of bile-stained fluid, often accompanied by hiccough, and later, without any appreciable intermission, of fecal matter, and persists until the end. Collapse follows quickly, and, without relief, death occurs in two to four days. Some cases are not so rapidly fatal, and strangulation, because not complete, may persist several days without gangrene of the intestine; but after the third day a new danger arises—peritonitis—which is equally as fatal, so that, if surgical aid is to be effective, it must be employed during the first two days—of course after an assured diagnosis. Meteorism is not marked at first with strangulation, and visible peristalsis is absent; the intestines are “dead,” as someone has expressed it. Still, Wahl has demonstrated that just before the constriction very often a short stretch of intestine may be found which has a full elastic feel, shows no peristalsis, and is immovable; percussion gives a tympanitic note, and shows this section to be moderately painful. This finding of a distended fixed portion of the intestine applies only to the very early stages, for later a general meteorism may be set up or peritonitis occur, and then this peculiar condition is obscured. Of course, no passage of feces or gas takes place, except the little lying below the narrowing, and that during the first few hours, for desire is always present, but later it is not uncommon to have watery passages without fecal matter, containing mucus and blood from the oozing into the lumen when the blood supply is not fully cut off.

Invagination may resemble either occlusion or strangulation to the extent to which its mesentery is carried between the opposed layers of the intestine, and hence its blood supply is cut off. The pain is sudden and intense, localized with difficulty, because chiefly in children, who complain only of a stomachache; the movements, which follow the pain immediately, are first liquid and fecal, later consist largely of mucus and blood, with very little fecal matter, and are accompanied with severe tenesmus. The vomiting soon follows the pain, but may subside for a time; the small patient refuses all food and lies in a state of

apathy; pretty soon the discharge of fecal matter and gas ceases, though the bloody mucus continues, thirst is excessive, and collapse follows. The abdomen is not particularly tender or distended, and usually the sausage-like tumor can be detected. Vomiting once more sets in, becomes fecal, and death arrives in from five to eight days if surgical aid is not summoned or the necrosed portion cast off.

Treatment.—The treatment may be properly divided into two stages—the one applied to chronic stenosis, where, for any reason, operation is not desirable or is declined by the patient; the other applied to those instances of complete obstruction or occlusion. In stenosis the diet plays a very important part, because those foods containing much cellulose (cabbage, onions, beans), from the production of gas, and berries with seeds, as well as nuts, from their large residue, may mechanically close a small orifice, through which minutely divided food material and feces without large refuse have successfully made their way. A diet list follows, which has enabled us to nurse along such patients for long periods without the dreaded outcome of complete closure:

DIET LIST IN INTESTINAL STENOSIS

Breakfast.—A glass of orange juice or grapefruit juice sweetened with milk sugar; toast, a couple of soft boiled or dropped eggs; a cup of tea or coffee, with cream, and milk sugar for sweetening.

Midforenoon.—A cup of beef tea, with a teaspoonful of somatose or laibose stirred in, and a soda wafer.

Dinner.—Soup (clear or thickened with flour only): beef, lamb, chicken, or fish, minced, or put through a meat cutter and all long shreds and bits of gristle removed before cooking; mashed or baked potato; mashed squash or chopped spinach, or the same put through a sieve; any jelly without seeds, or apple sauce, or the interior of a baked apple (avoid skin, seeds, and cores), served with cream, or gelatine and cream; a glass of brandy and water after finishing the meal.

Midafternoon.—A beaten egg, to which milk or a dash of brandy may be added.

Supper.—An omelet or a bowl of custard, some soft cheese (cream or Neuchatel); Vienna rolls or French bread (on account of the extensive crust), well chewed or softened in the tea; a cup of tea, with cream and milk sugar.

Bedtime.—A cup of beef tea or a glass of milk, with a teaspoonful of somatose or laibose stirred in.

The following articles should be strictly forbidden: cabbage, salads,

pickles, raw fruit, buttermilk (on account of the gas), Graham and whole wheat bread. Meat to be given only if no temperature is present.

As a portion of the mild cramps found in incomplete stenosis is due to spasm, a nightly suppository of extractum belladonnæ, 0.02 gram ($\frac{1}{3}$ grain), and a tablespoonful of liquid petroleum will often keep the patient comfortable for a long time. When ileus has set in, then all hopes of proper nourishment are to be given up; the persistent vomiting and the dilatation of the small intestine, if the obstruction is situated high up, allow only the hope that some liquid nourishment and stimulant—like albumin water, ice cream, black coffee, beef tea and well-diluted brandy—may be absorbed in sufficient quantities to keep up the action of the heart. When the case is prolonged beyond two to three days and the symptoms have somewhat subsided, we may proceed to rectal alimentation. Subcutaneous or rectal injections of physiological salt solution may also be employed to combat the intense thirst from which the victims suffer. The continuous administration method or proctoclysis is indicated, but the patients often complain so bitterly of the restraint that this application demands that it is often better to put into the rectum 250 c.c. at a time, which is usually immediately absorbed. Another means which often acts miraculously is gastric lavage. It diminishes the intragastric pressure, encourages the flow of the contents of the small intestine into the stomach, thereby relieving the distention by gas, and by that very means lessening the constriction if external. The lavage should be repeated every three to four hours. Rectal injections for purely mechanical purposes are of little avail if the obstruction is in the small intestine, for the fluid can rarely be made to pass beyond the ileocecal valve, nor can it do more than increase the twist in a volvulus of the colon, but, when there is an obstruction from packed feces or an invagination, the water may soften the mass and stimulate peristalsis in the one case or disinvaginate the intestine in the other if employed very early. For the latter purpose air may also be employed advantageously, introduced through a colon tube with a bulb syringe. Whether such irrigations can penetrate an organic stricture to such an extent as to soften feces packed above it is uncertain, although in an old man in whom a malignant stenosis seemed assured, with obstruction of twenty-four hours' duration, but no strangulation, six enemata of 1 liter each were given at four-hour intervals in the knee-chest position before the first fragments of fecal matter appeared. Whenever such copious enemata are given, it is very necessary to note whether all or a large part of the fluid is returned

before any more is given, lest the colon be overdistended and ruptured. To these injections the usual substances may be added—salt, soap, olive oil, and glycerine; in fact, each of these may be tried in turn in order to free the impaction. With the soda water, applied by attaching the nozzle of a siphon to the colon tube, we have had no experience, although this method has its adherents. Massage can never be justifiable except in fecal impaction, and then only when there is absolute evidence of no peritoneal involvement. The employment of drugs often plays an important part, but the first thing to learn is that purgatives must never be used in any form of ileus, except the fecal impaction, and, as this always occurs in the colon, irrigation will accomplish the same purpose, with less danger and discomfort. When used for any other form, laxatives simply increase the peristaltic storm, and the fecal matter is packed more closely about the narrow opening, the intestine becomes more distended, and rupture has been known to take place. Thus the warning to all medical men should be, "Purgatives are forbidden in acute ileus." Opium also serves an admirable purpose in the early stages by checking the restlessness, spasm, nausea, and vomiting, which allow the patient no rest, but after this violent onset is partially overcome, the point is reached where the opiate should be withdrawn, because it masks the symptoms and gives a false sense of security. Apart from its sedative effect on the patient, opium undoubtedly quiets the spasm of the intestine, which, by allowing no relaxation, prevents kinks, twists, and invaginations from becoming spontaneously released and the intestines restored to their normal position. The rule must be followed, however, never to give another dose until restlessness and pain show that the effects of the previous one have ceased, and it should be wholly withdrawn after twenty-four hours, unless a decision not to operate has been reached, when it may be continued, of course, to the fatal termination in order to aid euthanasia. The extractum opii, in suppositories of 0.05-0.1 gram (1-1½ grains), must be used, or, if the vomiting is not a prominent feature, 20 drops of tinctura opii deodorati may be employed until its full effect is produced. These increased doses of opium are far superior, for some unknown reason, to morphine, in relaxing spasm. The patient's persistent claims that, under the influence of the opiate, his ills have departed and he is recovering should never deceive the physician. The recurrence of passage of flatus and feces is the only criterion of the restoration of the integrity of the lumen. In recent years most favorable reports have been coming in of the beneficial action of atropine in relieving ileus by checking the tendency of the intestine to paresis as

well as overcoming spasm. After the first twenty-four hours' treatment with opium, if no relief of the obstruction has occurred, a hypodermic injection of 0.002 gram ($\frac{1}{50}$ grain) may be employed, and twelve hours later, if unrelieved, another injection of 0.003 gram ($\frac{1}{20}$ grain) should follow. When, after forty-eight hours of the combined use of opium and atropine, no passage of feces or gas has taken place, a laparotomy is our only refuge. Poisonous symptoms from these large doses rarely occur on account of the previous use of opium. When we are dealing with paresis of the intestine only, as after surgical operation and mesenteric embolism, and are assured that no constriction exists, we may employ physostigmine salicylate hypodermically in 0.0005-gram ($\frac{1}{120}$ -grain) doses with success, as well as the newer preparation, hormonal, intravenously, but they must never be used where the intestine is pinched or narrowed, for their use is wholly to stimulate peristalsis. This practically completes what we, as internists, can accomplish for the release of ileus, and ordinarily we have only forty-eight hours in which to accomplish it. If we maintain medical treatment, except in very few instances, beyond that period and then turn the case over to a surgeon, we have ourselves sinned and also put an extra burden on his shoulders. Even if we are not exactly sure of the condition in the abdomen of our patient, the time given for this study cannot be prolonged. Schnitzler says that an operation under false diagnosis at the right moment is better than an operation under the right diagnosis at the false moment. Delay in operation is naturally more justifiable in occlusion from fecal impaction—gallstones and invagination—than in strangulation and kinks, where the violence of the symptoms indicate the urgency of immediate action. On the contrary, when the signs of diffuse peritonitis appear, it is too late for surgery, and all we can do is to make the last hours of the patient as painless as possible. This decision, however, should not rest on the judgment of the physician alone, but on the conjoint advice of a surgeon, noted not so particularly for brilliant operations as for his sound opinion. The general condition of the patient will always remain an important guide as to the need of haste in operation. If the pulse remains not over 100, meteorism is not increasing, and vomiting has ceased—provided, of course, the patient is not stupefied with we may delay with safety, but all preparations must be made tion or transfer of the patient to a hospital if one is near. pendicitis, if at all severe, it is much wiser for the internist to surgeon early and share the burden of the question, "to be or be" with him.

CHAPTER XX

MALIGNANT GROWTHS OF THE INTESTINE

In the opinion of the majority of physicians this designation will always mean carcinoma—first, because the physician usually distinguishes only between benign and malignant tumors, and, second, because such an enormous percentage of these growths is carcinomatous. With the fine distinctions of sarcoma, adenoma, and myoma he is unacquainted. We are no more familiar with the causation of cancer—to use the generic and popular term—of the intestine than of the stomach. We do observe, however, that the straight stretches, where partially digested food and fecal matter pass rapidly and smoothly, cancer does not attack, but at the points where physiological stasis exists or passage is slowed and made more difficult—the rectum, cecum, colon flexures, and duodenum—the growth is usually found, but whether incited by mechanical or chemical irritation cannot be told. The lower rectum, too, with its hemorrhoids, and the sigmoid, with its surplus of hardened feces in constipation, are both inviting for the growth of malignant disease. It is in this region also that a polypus, at first bland and harmless, becomes so often the site for cancerous degeneration. Blows in the abdomen and other injuries in that region have been adduced as a cause for cancer, but probably the connection is not more close than that between the falls of small children and subsequent tubercular spinal caries, for there are but few of these victims from cancer who cannot remember an injury within a reasonable period of time. In frequency the cancer of the intestine, based on statistics of large hospitals, forms one-fifth of the malignant growths of the entire digestive tract. It has also been the impression of many physicians in large clinics that the number of intestinal cancers is steadily increasing, but A. Schmidt remarks that this is probably only relative—that is, in proportion to other diseases, like tuberculosis and infectious fevers, which are diminishing under the prophylactic campaign of the profession, while it stands helpless before cancer, and, we may add, which will continue until something is known in regard to its origin. Men are undoubtedly more often attacked than women, which is particularly true of low-lying growths (rectal and sigmoid), while as we ascend the tract the

difference between the sexes disappears. As with cancer in other situations, the years from 40 to 56 are most prone to these growths, though they are not unknown in younger persons; in fact, fifty cases were collected by one author in which the patients were less than 20 years of age. Practically all of the cancers found in the intestine are primary, though occasionally the rectum is involved by metastasis when that disease exists in the stomach or gallbladder.

The gross appearance of cancer may be nodular excrescences, with smooth surface, cauliflower-like forms, easily bleeding, or hard infiltrations of the intestinal wall. Very often interstitial tissue increases so rapidly that, from the contraction produced by it, the gut is constricted and shortened; here the symptoms of stenosis overshadow all the others. Again, the polypoid form rapidly leads to invagination, while its surface becomes ulcerative from the constant contact with stagnating fecal matter. These are usually superficial, but they may deepen and lead to perforation of the wall. For this reason, too, a cancer may run its course without any evidence of narrowing. Purulent collections may form, to which the patient reacts with a temperature, and, if situated in the ileocecal region, the mass may be taken for an appendicitis or a tuberculous affair. Acute diffuse peritonitis rarely accompanies an extension of a new growth beyond the intestinal wall, but much oftener the chronic form occurs, with marked effusion into the peritoneal cavity, which may be either chylous or blood stained. When the growth has once made its way through the wall to the peritoneum by continuity, it may extend to adjacent organs, with the formation of fistulae, and we may have, for instance, a gastrocolic or a rectovaginal communication. Intestinal cancers are slow to form metastases, though those of the rectum should be excluded from this statement in later stages. In its early course the growth can be removed with every assurance that the lymph glands are not involved. When metastases do take place, the glands are the first affected, then the peritoneum, then, in order, the omentum, lungs, and kidneys.

Symptoms.—The symptoms must necessarily depend on the location of the growth and, while stenosis is the same in all cases, yet in some instances the general condition may force these evidences into the background. Among these features is a progressive anemia of the character which we call secondary. This is probably aided by the inflammatory disturbance of the canal above the stenosis, for in cancer of no organ, except the stomach, is this anomaly of the blood so marked as in intestinal. The reasons for this must be sought in the absorption of infectious agencies and toxic material, as well as in the repeated loss

of small amounts of blood in the feces. While ordinarily this anemia follows the same course as any other accompanying a constitutional disease—like tuberculosis, for example—yet at times the picture presented closely resembles pernicious anemia in the variety of erythrocytes, their diminished number, and the color index of the blood. This anemia is usually early developed in some cases long before local conditions give us an inkling as to the presence of a growth, while in others the anemia is very late in making its onset when palpation clearly shows why the latter is present. Accompanying the anemia we may have emaciation and marked loss of weight, though one is often surprised at the excellent state of nourishment in which many of the victims of intestinal, particularly of colon cancer are as compared with the gastric form. On the peculiar cachexia which cancer patients were supposed to possess, one can put but little dependence, for it does not differ markedly from that of pernicious anemia, and advanced cases of malignant disease may show only the deathly pallor of secondary anemia. Apart from these general symptoms, we must rely on the local conditions for our diagnosis, and, instead of taking them in anatomical order from the stomach on, we will consider these new growths in order of their frequency.

RECTAL CANCER.

Rectal cancer includes those situated as high up as the rectopelvic fold, and hence may not be reached by digital examination, but can always be seen through the rectoscope. The pain experienced is not often of a colicky character and situated in the abdomen, but a tenesmus, which is persistent and unrelieved by defecation. The pain may also be felt in the lower back, and stream to the genitals and down the outer thighs. There are few evidences of the stenosis, except early constipation with packed rectum, and later frequent and fragmentary stools, sometimes termed "fractional." The stools may be tape or lead pencil form, or in the shape of scybala, or possibly cylindrical, or, from the excessive secretion above the cancer, may be the simple liquid diarrheal stool of colon catarrh. Blood-stained mucus in abundance is always present, and many discharges will contain no fecal matter whatever. Pure blood will never be found with cancer unless complicated with or the outcome of hemorrhoids. There is unquestionably a peculiarly putrid odor to these stools which are found in low-lying colon cancers where ulceration has begun that, in our mind, is not simulated by any of the discharges closely allied in gross appearance found

in dysentery, ulcerative colitis, etc. The same odor can also be detected on the patient, no matter how careful he may be in regard to personal cleanliness, which Zweig says is due to spots of bloody mucus which adhere to the linen in spite of the greatest care observed by the patient. Ordinarily a digital examination will detect the growth, whether as a hardening at one side, a mulberry-like growth extending into the lumen, or a rigid narrowing just beyond, but feeling as if coexistent with the sphincter. To make this examination to the best advantage, however, the rectum must be emptied by an enema, the patient placed on his back or side, with knees drawn up, while in the latter case the hand is placed between the thighs and the finger introduced with its convexity coincident with the curve of the coccyx. Unfortunately, however, we can not reach beyond 10 cm., and some of us even less than that, and the rectoscope must be called into play to reach the growth. This may require a cocaineization. If the rectoscope is not available, after etherizing the patient and dilating the sphincter, we may reach high enough to palpate the growth. We always have to differentiate such changes from tuberculosis, syphilis, proctitis, periproctitis, and chronic ulcerative colitis, and, when the gross appearance alone does not give us the desired information, a small section must be removed for microscopic examination. It is also necessary, so far as possible, to determine the size, the degree of adhesion, and movability of the growth with reference to other organs in the pelvis. It has often surprised us, when palpation showed a circumscribed and apparently pendulous malignant growth, whose upper limit one could perceptibly reach with the finger, to find the surgeon doing a Kraske operation to attain to its superior surface and complete its eradication. Such growths, too, often become adherent to the bladder and vagina and break into them, but a periproctitis, fistula, or peritoneal metastasis is rare, though the liver may be easily involved. Metastasis in the pouch of Douglas, secondary to a malignant growth of the stomach, must not be taken for a primary invasion.

COLON CANCER.

Colon cancer has symptoms which do not differ at first from those which have been described for chronic stenosis. In its earliest stage there is a feeling of distention or fullness at some locality in the abdomen, which is not necessarily the site of the growth. This is exaggerated at times during the day to actual pain, either following ingestion of food or previous to stool, which relieves it. This pain may

increase from day to day until it is a veritable colic, without any suspicion on the part of the physician of malignant disease, and colic may occur suddenly, accompanied by vomiting or even acute ileus, brought on by obstruction of the narrowed passage from the coarse fibers of asparagus, celery, or from other food containing much cellulose. The next thing which attracts our attention is either a moderate gaseous distention of the abdomen or spasmodic filling of a section of the colon—for instance, the transverse or cecum when the cancer is at the sigmoid, accompanied by pain. These grow so very slowly, however, and the narrowing accompanying them is so gradual, that even in advanced stages, where the tumor can be easily felt, no distinctive inflation or rigidity can be discovered, and yet the periodical attacks of pain are rarely wanting. In order to produce these exaggerated contractions, an enema of cold water has been recommended. One of the most suggestive signs is the frequent occurrence of mild obstruction in old people, which we often diagnose as "impacted feces," and relieve by mild laxatives and enemata, without a suspicion that we are dealing with a malignant disease until an attack more severe than the others is unrelieved by this simple treatment, and an operation shows a well-advanced cancerous narrowing. Sometimes gastric symptoms—anorexia, eructations, distress after eating, and heartburn—are most prominent, and lead us to regard the malignant growth as one of the stomach, which has been accounted for by a marked delay in the emptying of the latter, particularly when the ileocecal opening was involved. There is at first a marked restriction in the number and quantity of the stools, which in a person over 40 years of age, whose habits heretofore have always been regular in this respect, accompanied perhaps by occasional colic, should always arouse our suspicions of a malignant growth, which only the most painstaking examination can allay or confirm. Eventually, as colitis sets in above the constriction, frequent liquid stools occur, which are always filled with mucous shreds, blood, and often pus, much as would be found in a dysentery. One distinction from the latter is that in cancer of the colon the stools suddenly change their character and become hardened and formed. Cases have come under our observation, however, where frequent liquid stools persisted during the whole course of the disease. Small quantities of blood, detected only by chemical means, are an early and frequent accompaniment of cancer and can be fully utilized in diagnosis. Large quantities of blood as are found in hemorrhoids, however, are rare, and at best only a few bloody streaks may be noted mixed with the stool, associated always with mucus and pus.

The detection of the tumor mass is, of course, a positive proof of the pathologic condition, but this is possible in probably not more than half of the cases owing to its position under the liver—the fact that the type (scirrrous) does not produce a large growth nor a spasm of the abdominal muscles. To satisfactorily palpate such a tumor, the intestine must be emptied by an enema or mild laxative, for an accumulation of fecal matter or gas sadly interferes with this detection by the fingers. These tumors are noted for their motility. Not only by the change of position of the patient, but by the examiner's fingers, can they be moved about, particularly where their mesentery allows freedom, as at the sigmoid, cecum, and transverse colon. Advantageous aids for bringing the tumors more distinctly under the fingers have been suggested, such as inflating the colon with air by means of a syringe, or placing the patient in a hot bath during examination. This motility is only a feature when no adhesions have formed, and it often happens that acquired or congenital anomalies of position, as well as pressure of a distended intestine above, so distorts the site of the tumor that mistakes are often made as to its anatomical relations. Adhesions to the uterus, bladder, and kidney are not uncommon and confuse the diagnosis; growths of the transverse colon, as well as its upper flexures, move with respiration, and also those of the stomach when nonadherent. The growth itself is noted for its extreme hardness, while its surface may be smooth or nodular. Its size varies from a walnut to that of a grapefruit, and is usually overestimated by palpation for the portion of the intestine above it, especially if beyond the center of the transverse colon, where the feces begin to solidify, is filled with hardened fecal matter, whose consistence is difficult to differentiate from the mass, so that their volume is reckoned with it. These tumors are tender, and sometimes painful to touch, though rarely we find one which apparently has no sensitiveness. So much depends on the correct interpretation of any mass found in the abdomen that a word must be repeated in regard to the confusion of malignant growths with fecal tumors. The sensation of touch is much the same. Palpation of the latter may produce pain from an conjoint localized colitis, and the secondary fecal tumor mentioned, which forms before the constriction, will often disappear under the influence of laxatives, as well as a true fecal impaction, so that, after any obstruction has been relieved, particular pains must be taken to detect, if possible, a small intestinal growth. This need not necessarily be malignant; in fact, it is sometimes found to be tuberculous. This is particularly true of tumors at the ileocecal valve, which can sometimes be differentiated by

the detection of tubercular bacilli in the fecal mucus, as well as by the diazo reaction of the urine, and purulent appendicitis may cause difficulty particularly where, without any violent pain, a tumor suddenly appears with rise of temperature, as in a case under our observation, where a surgeon declined to operate, and on the fifteenth day both the mass and temperature disappeared simultaneously. Here the



Fig. 84.—Radiogram of cancer of the descending colon (bismuth ingested). (Collection of Dr. Atrial W. George.)

diagnosis of probable malignant disease had been made by another physician. The x-ray examination offers marked aid in establishing the presence of a stenosis, but apart from that we can learn little; in other words, the peculiar contour of the lumen cannot be utilized as in the stomach in favor of cancer. The bismuth may be introduced by enema or ingested, and in the latter case the accumulation before

the narrowing and absence beyond usually indicate its size. The reverse is true when enema is employed.

Accompanying symptoms due to other organs are very common—for



Fig. 81. Radiogram of cancer of the hepatic flexure of the colon (bismuth ingested). (Collection of Dr. Aram W. George.)

instance, pressure of the tumor mass and distended coils of intestine often produce vesical tenesmus, and the entrance of the *baeilli coli communis* sets up cystitis. Again, the act of defecation may cause

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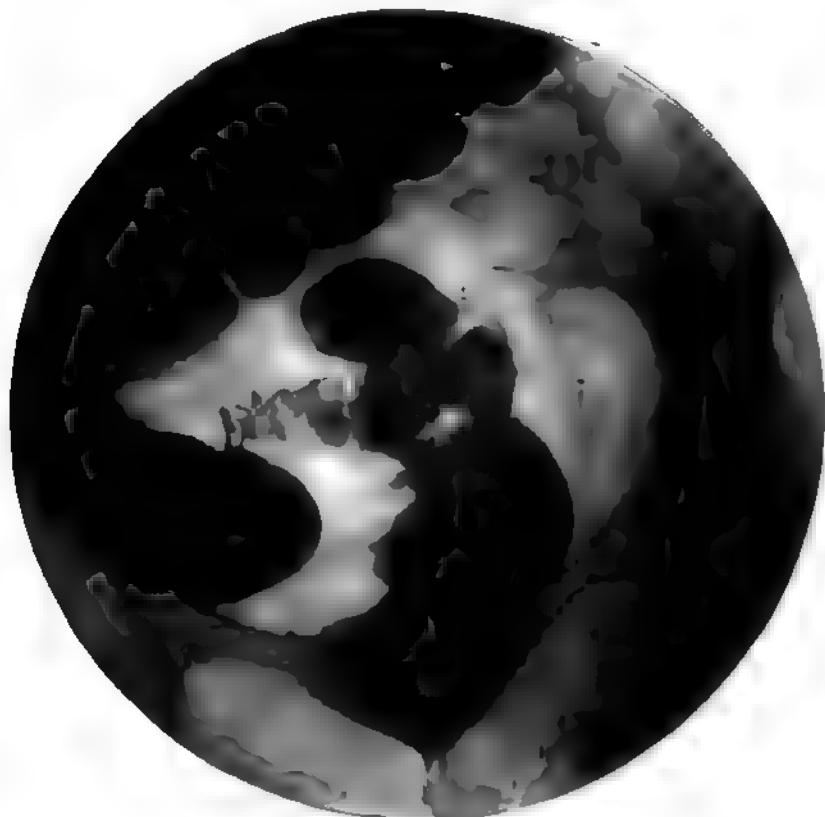


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CANCER OF THE SMALL INTESTINE.

Cancer of the small intestine, other than the duodenum, is very rare, and its diagnosis during life still rarer. A palpable mass may be absolutely wanting, and only the increasing pallor and emaciation attract attention to the fact that the patient is seriously ill. The stenosis grows very slowly, and its first evidences may be alternation of constipation and diarrhea. Later spasmotic and irregular pains situated near the navel are experienced, and there may be a localized gaseous distention and spouting sounds. Occasionally attention is not called to the intestine as the source of the secondary anemia until a complete occlusion, with early vomiting, indicates clearly where the trouble lies and its causation. A large amount of blood seldom occurs in the stool, and cases reported have been too few to give us any idea as to the frequency of "occult blood."

Diagnosis in one of its most difficult fields in the realm of medicine may allow one to recapitulate some of the most suggestive factors in the detection of intestinal cancers. As the duodenal form is closely allied to that of the stomach, and the jejunileal rare and seldom detected, we turn our attention to the most frequent—those of the rectum and colon. Discharge of mucus and blood in an elderly individual must never be regarded as an outcome of dysentery or hemorrhoids without investigation, for it may as often accompany a cancer of the rectum or sigmoid. Colies in elderly people who have been free from them during life (especially after coarse food) cannot be attributed to constipation, though that may be present, but, if lead poisoning, tuberculosis, and syphilis can be excluded, must always arouse suspicion of malignant growth. A mass at or near the cecum, accompanied by temperature, without the violent onset of appendicitis, will always in people of a certain age cause much uncertainty, unless an absolutely definite history of previous perfect health can be obtained—often a difficult thing—or, as in the case mentioned above, the mass disappears. Cancer of the hepatic flexure is particularly prone to be diagnosed as cholelithiasis, since no jaundice is necessary to prove the existence of the latter, and pain in the right back is common to both. The attacks of gallstone colic are almost never dependent on food, and are extremely erratic in their onset, while, in colon cancer, pain is fairly regular and can usually be aroused by food, either directly or two hours after a meal, by certain positions (lying down after a meal), and there is the usual absence of rise of temperature or chill during an attack. It is rare, too, that cancer of the colon will not cause

changes in the character of the stools, which cholelithiasis will not do, unless the common duct is blocked.

Tumors in either lumbar region require some study to differentiate their association with the colon or kidney. If with the former, there is usually a peritoneal rub and occult hemorrhage, while ordinarily the colon can be rolled over a retroperitoneal growth. Inflation of the colon with air, as mentioned in the consideration of general diagnosis, will obscure a renal tumor and make an intestinal one much more prominent. Under these conditions, too, a previous dullness over the mass will be diminished or disappear if the mass is renal.

All tumors about the sigmoid must be interpreted very reservedly, both because of the frequent accumulation of scybala there and the frequency of perisigmoiditis. There is much more gratification, however, after recommending an exploratory operation, in finding a large inflammatory exudate than a malignant disease with glandular or peritoneal involvement, so that, when in doubt, our decision will always be to operate if the patient's condition permit. There is so much confusion in regard to the length of life if cancer uncontrolled is allowed to run its course, that one hesitates to state actual periods of time. R. Schmidt regards the duration of two years for colon cancer as out of the ordinary. The rectum carcinoma is taken a little more favorably, since Boas and Eichhorst have seen a duration of three years. Others do not agree with Schmidt's dictum, and relate instances of colon cancer where life has been prolonged four to six years without operation.

Treatment.—Treatment, if effective, must always consist of the complete removal of the growth, but, in order to accomplish this, early diagnosis is even more important than in gastric cancer. This, unfortunately, is rare, and often, to our disappointment, when it seemed as if the earliest possible moment had been taken when an opinion in regard to the pathologic condition could be given, the surgeon at the operation has pronounced the dire words, "glandular or peritoneal involvement," and sewed the patient up again. Under three conditions the operation is worse than useless: (1) when age, marasmus, and the low hemoglobin of the patient indicate lack of resisting power—they simply drop out of existence at the end of seven to ten days without any definite cause where removal has been complete and there were no involvements; (2) when metastases and adhesions can be detected, which exclude a radical removal unless, as in a colostomy, to relieve the pain; (3) where marked ascites indicates the general involvement of the glandular system and operation does

not promise even temporary relief. Such a condition was found in a case of ours where, after the exploratory operation (undertaken for diagnostic purposes), the persistent ascites never allowed the abdominal wound to close. If *ileus* accompanies the cancer, a palliative operation is much better, and later, if desirable, a radical operation can be performed. Whether a complete extirpation is practicable must depend always largely on the exploratory laparotomy, because, given a fairly young patient (50 to 60 years), with not too great cachexia, the question is based largely on adhesions and metastasis, the degree of which will be difficult to determine without actual vision of the growth. Without the laparotomy, the invasion of two parts—as, for instance, the colon and the mesentery or the intestine and the ovary, or in all cases a mass of glands in Douglas' pouch—of course indicates at once the hopelessness of operative intervention. As a whole, we think all internists are a little distrustful of their own ability to determine positively the progress and extent of malignant disease of the abdominal organs without the aid of the surgeon's more intimate touch and vision of the organs there, so that, where there is any indecision in our own mind, the laparotomy is recommended—not to make a diagnosis, against which some physicians rightfully object, but to determine the extent of the disease, which the internist's restricted facilities cannot establish. Now, taken for granted that the growth cannot be successfully removed, whether the decision be reached by the aid of fingers, eyes, and ears, or by the knife, what should be done to aid euthanasia? As pain is almost always invariably produced by coarse food or by articles producing flatulence, though R. Schmidt speaks of a sufferer who was always relieved for a time by sauerkraut (probably on account of its laxative effect), we are to look closely after the diet, and its choice will largely depend on whether the growth is in the large or small intestine and the extent of the narrowing. If the growth is high up in the tract, moderate gastric dilatation will eventually take place, and the diet given on page 331 for gastrectasis, following pyloric narrowing, is in order. That lower down the tumor lies, the greater the care that must be taken with the diet, for complete obstruction from indigestible food is a common occurrence. A. Schmidt mentions a fragment of lettuce leaf which acted as a valve at such a stenosis. Hence all food must be either liquid or semisolid, containing as little insoluble residue as possible. Such a diet has been given on page 511 for intestinal stenosis, since that is the condition we are trying to overcome, irrespective of its origin. Eventually we will have periods of constipation which

must be relieved, for the accumulation of feces above the cancer not only increases the pain and inflammation of the intestine in the same locality, a means often of discharging the accumulation by provoking diarrhea, but from supposedly autointoxication often causes a rise of temperature, which still further increases the wretchedness of the victim. As we are forbidden the use of cellulose, for reasons mentioned, we are confined to fruit juices (orange, grape, lemon, and apple), to milk sugar in large quantities, and the use of honey and molasses. Still, we are often unable to overcome the retention, and then must have recourse to only the mildest laxatives—fluid extract of cascara, aromatic tincture of rhubarb, or magnesium sulphate—the last preferred by many on account of the extremely liquid stools produced by it. Pills must never be given on account of the possibility of their insolubility and obstruction of the narrowed portion. Then, there soon comes a period of diarrhea, which again taxes our ingenuity to control. The stools are usually putrid smelling, and show putrefaction rather than fermentation, so that we may exclude meat and eggs for a few days and give gelatine, strained oatmeal, and barley soups instead. On the contrary, when the growth is situated high in the small intestine, the liquid and fermentative stools, frothy, with acid reaction, sometimes occur, and then we must exclude the starchy foods—bread, rice, puddings, and potatoes—and feed our patient on finely chopped meat, eggs, soft cheese, custards, and gelatine. Apart from the diet, it is not advisable to check the diarrhea for a day or two, because it is nature's method of relieving the distended intestine of its accumulation of feces above the stricture. When it threatens to become too prostrating, it may be treated as ordinary ileocolic catarrh with tannalbin, or, as the growths are situated chiefly in the colon, by irrigation with dermatol in gum arabic water (2:250). Of course, pain will necessarily demand opiates sooner or later, but it is often surprising how long one can get along with substitutes like phenacetin, codeine, spirits of chloroform, etc., without the employment of opium or morphine. This applies only to periods where there is a moderately free passage through the stenosis. Just as soon as a complete obstruction occurs, then opiates and the directions for relieving ileus must be followed.

POLYPI.

Polypi, or adenomatous polypi, which is the more accurate term, since it is to this group that the medical men refer when using the name, are on the border line between benign and malignant growths;

in fact, even when fully exposed to view it often requires an accurate pathologic examination to decide this question. It is a fact, too, that, though they may exist for years as benign growths, eventually, from constant irritation, they undergo carcinomatous degeneration. They may be single or multiple and grow slowly, even when the malignant change has not taken place. In size they vary from a pea to a walnut, are sometimes pendulous, and then, again, they may be seated over a fairly large base with numerous excrescences. In our cases they have always been found in the rectum within reach of the finger, but they may occur in the colon, rarely in the small intestine, and occasionally about the anus. Of the causation little is known. Venous stasis has been suggested, but, as they are found in children less than 10 years of age, congenital influences may play a part, and it has even been stated that they have been discovered in different members of the same family. An explanation of the malignant degeneration has been offered by Hauser in the additional opportunity extended for irritation by the polypi floating in the lumen of the intestine. This is encouraged by the fact that, when multiple, perhaps only one—and that the most extensive—may be so affected.

Symptoms.—Symptoms are much milder than those of annular carcinoma of the rectum, though resembling them in some ways—tenesmus and bleeding at stool, which is at first taken for hemorrhoids until examination discloses the small excrescences. In one of our cases (a woman) constant backache was present, and the polypus, which produced tenesmus, but did not bleed, was discovered. Its removal freed the patient from backache, but the causative connection between the two will always remain in doubt in our mind. Fortunately no malignant degeneration had taken place, though the surgeon pronounced it cancerous at its removal; this was refuted at the pathologic examination. When higher up, these growths may give rise to bleeding, without other symptoms or may produce severe colon catarrh, with pain, diarrhea, and the discharge of much mucus. Patients become anemic from the frequent loss of blood, but, unless cancer supervenes, the patients may live many years. Whenever such growths are discovered by the finger or rectoscope in the rectum, they should be removed as a source of danger, but, if this is impracticable at the time, at least a small portion should always be removed and submitted to a pathologist.

Treatment.—The treatment, apart from excision, which is often impracticable when they are multiple, comprises a diet designed to allay the colitis and irrigations with astringents, of which dermatol is the most satisfactory.

CHAPTER XXI

NERVOUS DISEASES OF THE INTESTINE

This subject comprises those changes in the normal motility, secretion, and sensibility of the intestine dependent on the perverted nerve innervation—at least in which no pathological change in the intestinal tract can be found. As stated, these cannot be absolutely separated, or at least they run into each other, for in chronic catarrh of the intestine any excitement exaggerates the number of discharges, and a long continued constipation, due to nervous origin, may set up a colitis from the irritation of the fecal matter on the mucous membrane. The causation of this intestinal neurosis is probably much the same as that given for the gastric—hereditary weakness of the nervous as well as the muscular system—both contributing to displacements of certain divisions of the intestine if we are to believe that there is an absolutely normal site for every section, which some are beginning to doubt; at least functional diseases of the intestine are rarely found in well-nourished and robust individuals. Then, we have the paresis by reflex action from other organs, as from peritonitis or acute pancreatitis; by direct influence from the brain, as the paralysis following myelitis or apoplexy. There is, too, a close connection between the neuroses of the stomach and intestine, but whether one is dependent on the other may be doubted. It is much more probable that both are based on the faulty central nerve innervation; for instance, a gastric myasthenia, with a loudly succussing stomach, hours after the latter should be free from food, will be associated with constipation. Following the general division of nervous anomalies of the stomach, we have those of the intestines, as given below:

A. Disturbances of motility.

a. Increase.

1. Cramp or spasm of the intestine.
2. Peristaltic unrest.

b. Decrease.

1. Paresis and paralysis of the intestine.
2. Loss of action of sphincter.

- B. Disturbances of secretion in the intestine.
- C. Disturbances of sensation.
 - a. Hyperesthesia.
 - b. Neuralgia.

CRAMP OR SPASM OF THE INTESTINE.

Cramp or spasm of the intestine means the persistent tonic contraction of the whole or a section of the tract—a veritable tetanus. Normally this does not occur, so that there must be some source of irritation. Nothnagel, by placing a crystal of salt on the peritoneal surface of the intestine, and others by the faradic stimulation of the same, have produced a spasmodic contraction, by which the section becomes bloodless and its lumen obliterated. This spasmodic contraction probably accompanies most, but not all, attacks of painful colic, and it may vary in intensity, so that the obstruction may be partial or complete. From this category must be excluded, of course, those spasms produced by ulcer of the mucous membrane, or, reflexly, those that often exist in the entire tract, when a portion of the small intestine is pinched. These two conditions of primary and secondary spasm have been heretofore confounded, but the x-ray has shown us that there may be long continued persistent contraction of the intestine, sufficient to obliterate its lumen, and even to lead to ileus which is wholly of nervous origin. When we look for the cause of this condition, we recognize first the deleterious influence of lead and nicotine. Lead, in addition to causing a moderate contraction of the entire intestine, produces an irritation of the sensible nerves, which at times is exaggerated to a paroxysm of pain. Then we have the unexplainable local neuroses, which cause contractions of sections of the gut, not always accompanied by pain—sometimes not sudden, but gradual—until it is severe enough to cause ileus, and at operation, apart from the narrowed portion of intestine, not a vestige of any pathologic condition can be discovered which would account for it. This is not a part of a general neurasthenia, but a purely local neurosis. Spasms dependent on tabes and accompanied by pain are often seen. The spasm of the anal sphincter in this condition is readily detected, and those of the colon can be usually found if searched for. How much the canoe-shaped abdomen and absence of tympany in meningitis are dependent on spasm is not known, but at least it is not accompanied by local pain. These, of course, would both be the result of central nervous influence.

Symptoms.—The symptoms necessarily vary in accordance with the extent of the intestine affected. In lead colic the entire tract may be in a state of contraction for days, with retracted flattened abdomen, while, again, in a localized abdominal neurosis a portion of the small intestine or colon may show a localized stasis above the narrowing, and, slowly developing, may lead to moderate rigidity and symptoms of ileus (vomiting). Pain usually accompanies the spasm, but is not constant and may disappear, while the constriction still persists. It starts from some point in the abdomen and then streams over its entire surface. Then, again, the severity of the pain bears no relation to the strength and force of the contraction. By palpation little or no tenderness can be elicited, at least nothing commensurate with the constriction, which may be so great that the colon, for instance, feels like a band or cord. The most constant and prominent symptom is the retention of flatus and feces; this is not absolute, however, and the gas passes now and then sparingly. There is not the meteorism common in organic stenosis of the intestine and the ileus usually spontaneously vanishes, though it may go on to fecal vomiting and an operation be necessary, as many reports in the literature show. The relaxation of the spasm is always accompanied by free passage of gas and feces. The general condition of the patient, too, is rarely disturbed except from the pain, the pulse is not increased, nor are there any evidences of collapse. The differentiation between spastic and organic closure of the lumen of the intestine is extremely difficult. The lessened severity of the former, and its more frequent occurrence in younger individuals with unstable nervous equilibrium, helps some, but one cannot rely too much on this alone, and the case must be as closely studied and cared for as though we anticipated the possible disastrous outcome of true organic ileus.

Treatment.—The treatment is often also our best means of diagnosis, and the hypodermic injection of atropine sulphate, 0.001 gram ($\frac{1}{60}$ grain), will often check the vagotonus, commonly regarded as a cause of the spasm, like magic, and many of the cures of organic stricture reported are undoubtedly of this character. It may be necessary to repeat the dose under the same precautions mentioned in true ileus. The success of the treatment is soon demonstrated by a free passage of gas and feces. In addition to this, the hot hip-bath or electric pad to the abdomen is also very efficacious in relaxing the spasm. Irrigation of the colon with a pint of warm water, containing a teaspoonful of spirits of peppermint, also aids. Laxatives had best be avoided altogether, for they increase the spasm.

PERISTALTIC UNREST.

Peristaltic unrest of the intestine consists of a series of exaggerated contractions of the tract, associated with a general neurosis, and not the result of any local affection. Clinically, it makes itself manifest by borborygmi, which may continue for hours. They are aroused by many forms of mental excitement, such as entrance into social gatherings, where they are particularly humiliating to the victim; in others they continue for two or three hours after food is taken, or after the use of cold drinks containing carbon dioxide, as the prevalent soda water. Its peculiarities consist chiefly in its irregularity; it may cease for weeks or months, and then, without any known cause, start in again.

The patient, when awakened at night, often hears these noisy movements of the bowels, but little or no gas is passed and stool never follows. The stomach may be found also to participate in these exaggerated motions without producing eructations or vomiting. As these motions occur more often in persons with thin abdominal walls, with diastasis of the recti, the segments of intestine can be distinctly seen to fill and collapse, but the distinction from a rigidity due to stenosis is very marked, since the former loops of intestine are not filled with fluid and are much less plastic. Ordinarily the patients complain of no pain, or at least only of a feeling of mild discomfort, which is localized in the abdomen. From a careful study of these cases it would seem as if there was nothing pathologic about these movements, but that they are only an exaggeration of the normal physiologic pendulous contractions. Generally only undernourished, hyperexcitable persons are affected, and on this fact one bases his diagnosis largely, at the same time leaving no stone unturned to exclude beginning stenosis by examination of patient and stool.

Treatment.—The treatment must be directed largely to the patient's general condition, and, as this is one of malnutrition and unstable nervous equilibrium, we can only repeat the course of extra meals, cold baths, massage, change of climate, electricity, etc., which has been advised for a person in that condition. To combat the local vagotonus to which these manifestations are due, we may use a powder containing extractum belladonnæ, 0.020 gram ($\frac{1}{5}$ grain), combined with magnesii oxidum 0.3 gram (5 grains); validol and codeine can also be employed to advantage.

PARESIS, OR PARALYSIS OF THE INTESTINE.

Paresis, or paralysis of the intestine, has proved the bugbear of the surgeons on account of its frequency after abdominal operations—"postoperative ileus," as it is sometimes called—but we must distinguish one form, associated with peritonitis, and a second, which has nothing to do with infectious complications. The peritonitic form may follow all kinds of abdominal operations, and comes in the first few days. It is also seen in every perforation of the intestine and in sepsis whenever the diaphragm is attacked. When an ulcer merely attacks the peritoneum, but does not break through it, we never see this paralysis, and even in typhoid and intestinal tuberculosis a partial paralysis or paresis with meteorism is much more common, undoubtedly caused by the peritoneal irritation of an ulcer. Urine, bile, and blood, when poured into the peritoneal cavity, produce incomplete paralysis, due in part to infectious agencies, but oil or oxygen, when introduced experimentally, will cause the same paresis, nor can the intestines be exposed too long to the air in laparotomies without danger of a similar effect. The reflex paralyses account for many instances of fatal obstruction after surgical operations when not the slightest vestige of inflammation can be found. We have many examples of this following the tapping of the hydrocele, the kinking of a ureter in a prolapsed kidney. Then there is occasionally found a paresis associated, if not caused, by gallstone or renal colic, and possibly other painful affections of the abdomen. The inhibitive influence which comes from the brain and produces intestinal paresis is usually present only when that organ is suffering from an attack of apoplexy, but such an onset may also arise from tabes or has been noted in acute ascending paralysis. Mental depression and melancholia certainly diminish peristalsis, yet whether they ever lead to complete paralysis is unknown, but hysteria has been found to produce so complete an ileus that operation was undertaken for its relief. Then, at last, we come to the paralysis caused by strangulation. Owing to the burden placed upon the segment just before the narrowing, it hypertrophies and overcomes it for a certain time, but at any moment may become paralyzed, and peristalsis ceases long before the obstruction of the lumen has become complete.

Symptoms.—The symptoms of complete paralysis are, first of all, meteorism, which usually involves the whole tract, but after surgical operation may be confined to certain segments of the intestine. The extent of this gaseous distention is governed largely by the overdevelop-

ment of the patient's abdominal muscles and peritonitis, both of which tend to restrict the distention, while it reaches its greatest extent in persons with thin-walled abdomens. The diaphragm is pushed up, and respiration is always costal and shallow. The percussion note is highly tympanitic, except over an occasional filled coil, where it may be metallic, and, as soon as peritonitis develops, the flanks will be flat, but the note will be hard to elicit because of the enormous tympany; the lumbar region will give it best. All spontaneous sounds in the abdomen have ceased, and even with the stethoscope nothing can be heard. In this respect a primary paralysis differs decidedly from a primary stenosis, where the spurting and gurgling sounds are very prominent. Pain is practically absent, unless due to the primary disease, as peritonitis, which has been known to run its course without pain, but such a case is a rarity. Accompanying this peritoneal pain there is also a fully disseminated tenderness of such a character that the patient cannot endure even the weight of the bedclothes. Both these factors in regard to pain militate against ileus from strangulation, for, as has been described, tenderness in the latter is minimal, and the pain is paroxysmal and not constant, as in peritonitis. Discharge of stool and flatus ceases in paralysis, although one or two movements at its beginning have been known. Introduction of a colon tube does not relieve the meteorism, nor can enemata wash out more than a few fecal fragments situated in the ampulla. Vomiting never occurs until the cessation of stool and the largest degree of distention has been reached. It is often preceded by the most distressing hiccoughs, and the vomitus consists of the last liquid food taken, and rarely of duodenal contents until very late. Finally, fecal vomiting sets in, but is not so persistent as in mechanical obstruction, and also comes much later. After the paralysis is well established, the signs of shock, pinched nose, sunken eyes, livid hands, and cold sweats, with rapid pulse, supervene, just as described under strangulation. We may have these earlier, when the paralysis is dependent on gallstone or renal colic, but there is an interval of temporary recovery before the same symptoms recur. Associated with the cessation of peristalsis, temperature and blood count are so erratic that no dependence can be placed on them. Localized peritonitic processes are usually associated with an increase of white corpuscles and temperature, but general peritonitis may present a normal temperature and a reduction of the leucocytes. The urine diminishes rapidly until anuria may result; the bladder, too, may become paralyzed as a complication. Indicanuria is always present early, because of the relaxed ileocecal valve, which allows the

putrefactive bacteria to enter the small intestine. Incomplete intestinal paralysis or paresis differs from the complete form only in degree. It never approaches the state of collapse, and, if vomiting occurs, it is only as a reflex and never fecal in character. Meteorism and cessation of flatus and stool may be equally as well present, but with this difference—while today the conditions are most unfavorable and indicate complete paralysis, during the night some gas may be passed and an enema produces an evacuation of fecal matter, relieving all the symptoms, while the stethoscope often discloses some intestinal activity. The changing character of the severity of the symptoms and the alternations of peristaltic activity and quiescence are the chief characteristics of this form, although it may eventually result in death. The distinction between a paralysis from lack of innervation and from a stenosis is very difficult, and one in which time is the umpire. If cessation of stool and flatus are unaccompanied by spasmodic pain and rigidity of certain segments of the intestine, the former may be taken for granted; if, however, these symptoms have been preceded by a period of spasmodic pain and localized tympanites, the condition may still be due to stenosis. Then, too, when on the first or second day after a laparotomy there is found an increase of the pulse, vomiting, meteorism, and rigidity of the abdominal muscles, while neither gas nor feces passes, it does not take long to decide that this is due to no reflex stimulus, but paralysis from a beginning peritonitis. When this is followed further by rise of temperature, oliguria, fluid in the flanks, and signs of collapse, this opinion is still more strongly fortified, though peritonitis may exist without vomiting, tenderness of the abdomen, and muscle spasm. When, on the contrary, the first few days elapse without significance, and then there is absence of stool and no passage of flatus, moderate distention coming on slowly, but no tenderness or spasm of the abdominal muscles—while the temperature remains normal and the general condition good—we must look elsewhere than to peritonitis for the cause of our paresis. In other words, as stated, it is the time and rapidity of the development of symptoms on which we base our opinion.

Treatment.—The treatment can be said to be wholly surgical when peritoneal complications are present, for, whatever may be thought in regard to physical or medicinal means in obstruction from obturation and stenosis, there can be no question that, once the diagnosis of intestinal paralysis accompanied by peritonitis is assured, its victim is the subject of a surgeon's efforts. The surgical means of relief will not be discussed here, but many surgeons attempt to prevent such a

complication by a hypodermic injection of physostigmine salicylate in doses of 0.0005 gram ($\frac{1}{120}$ grain), but it has always seemed to us that ether was not wholly an unmixed blessing, since it allows the surgeon to unnecessarily manipulate the abdominal organs and removes the need of rapidity; hence greater speed and less handling of the organs would seem the greatest prophylactic. When, on the contrary, there are no peritoneal complications, we may safely make use of medicinal means to overcome the paresis, and, curiously enough, atropine, which we employ to stop spasm, in larger doses stimulates peristalsis and can be given hypodermically in these cases in doses of 0.003–0.005 gram ($\frac{1}{20}$ – $\frac{1}{12}$ grain). As we have a natural fear of such large doses on account of the almost certain occurrence of toxic symptoms (dry throat, dilated pupils, and great mental excitement), we may inject 0.001 gram ($\frac{1}{60}$ grain) at three-hour intervals until the maximum of 5 mgms. is reached; if successful, the passage of gas and stool begins almost at once. Physostigmine salicylate may also be used for overcoming a paresis unaccompanied by peritonitis as well as for prophylactic purposes, but only where it is certain that no stenosis exists. Irrigations with a colon tube may be tried, either alone or in conjunction with the faradic current, which has its advocates. There is not the slightest doubt that it will produce powerful contractions of the sphincter, but its action on the intestine above is somewhat in doubt. When vomiting begins, gastric lavage should be employed at frequent intervals, which has the power of stimulating intestinal peristalsis in the same way that colon irrigation does. When the symptoms of collapse come on, camphor in oil as prepared in ampules, or strophanthin in 0.0005-gram ($\frac{1}{120}$ -grain) doses, should be injected with a hypodermic syringe. Hormonal still remains an effective (if used intravenously), but dangerous, remedy, and should be employed as metallic mercury was in the old times for the same purpose—only as a last resort. That most distressing symptom—thirst—cannot be gratified by unlimited amounts of water, because each glass is usually followed by vomiting, which exhausts the patient, but must be combated with lumps of ice or small quantities of champagne.

LOSS OF ACTION OF THE SPHINCTER.

Loss of action of the sphincter is chiefly found in disease of the cord (tabes and myelitis), chronic dysentery, proctitis, and particularly prolapse of the rectum may cause an open anus. Men with urethral strictures and women with perinea torn at labor, including probably

some of the anal muscles, both often have an uncontrollable sphincter. There are all degrees of this weakness. Many have control when the stool is formed, but lose it as soon as it becomes liquid. Any sudden motion—sneezing, coughing, laughing, or raising an object—causes the involuntary discharge of flatus and often of feces. In the various forms of paralysis of the sphincter from disease of the spinal cord, the patient has no knowledge of the act of defecation, which is not continuous unless the feces are liquid, but occurs as often as the ampulla fills. In these cases, too, three or four fingers may be introduced through the anal opening without any resistance. Ordinarily there is also loss of the vesical sphincter, so that both urine and feces are passed unconsciously.

Treatment.—The treatment comprises repair of a torn perineum or a divulsion of a stricture, if either exists. Local treatment of a proctitis with dermatol and a powder blower will help that variety, but for those arising from disease of the cord but little can be done, except to arrange the diet so that the stool shall always be formed, by eliminating fruit, green vegetables, and sweets. The employment of a faradic current with a rectal electrode and a broad pad upon the abdomen, in conjunction with the use of rectal suppositories, twice daily, of strychnine sulphate 0.010 gram ($\frac{1}{6}$ grain), may be tried, without much expectation of any more than temporary relief.

DISTURBANCES OF SECRETION.

Disturbances of secretion manifest themselves in two forms—nervous diarrhea, which is undoubtedly due to a primary hypersecretion of intestinal fluid, and is considered under the functional disturbances (page 428), and mucous colitis, where the discharge of pure mucus without fecal matter has been regarded by some authorities as of purely nervous origin, and by others as being an outcome of a low grade of colon catarrh. This, too, is discussed on page 461 under chronic mucous colitis.

DISTURBANCES OF SENSATION.

Disturbances of sensation experienced in the abdomen without any gross pathologic change are rare, but still they do undoubtedly exist. It is safer always to consider that there is a cause which we cannot find than to too easily ascribe all pains in this region to neuralgia. There are, for instance, chronic appendicitis and duodenal ulcer, ad-

hesions, following all forms of operative intervention, or spontaneous disease, which cause pain when different parts of the tract are over-filled with liquid or gaseous contents. Then there are diseases of the kidney, gallbladder, or female genitals, the pain of which may be carelessly attributed to intestinal neuralgia or gastralgia without a more careful investigation, not to speak of myalgia of the abdominal walls, to which A. Schmidt has called attention.

INTESTINAL HYPERESTHESIA.

Intestinal hyperesthesia applies to those disagreeable, unpleasant sensations localized in the abdomen and described as "fullness," "burning," "tearing," and "stabbing," but rarely approaching actual pain. They usually occur at a definite period after food is taken, but may equally as well come after excitement, muscular strain, or follow no law whatever. Several patients of ours were awakened early in the morning by these sensations, which were ascribed, as they often are, to gas, but laxatives, carminatives, and enemata, taken as soon as the former were felt, failed to produce any effect. The individuals were otherwise in excellent health, and some reported that while on vacations these dolorous sensations disappeared. They may be experienced over the whole abdomen or in localized sections, of which the ileocecal region is the most common, the sigmoid next, and finally the rectum and anus, particularly the last when there is coincident sexual neurasthenia. Many of the sufferers from these sensations belong to the great group of neurasthenics and hypochondriacs, and have the most persistent fixed ideas. Many feel assured that they have an inflamed appendix and demand operation. Another patient declared that he had a stricture of the intestine, and was positive he could point out the very spot where it was situated. Before he came under our care a surgeon had opened his abdomen twice without finding the stricture, but the patient's conviction of his condition was just as strong. Another powerful, absolutely healthy business man, somewhat overworked, insisted he had a cancer of the intestine, though his discomfort never approached actual pain and he had never lost a pound of flesh. It has been our experience that such patients stick tenaciously to their preconceived ideas and put but little reliance on a physician's physical examination. The x-ray, however, impresses them, and, if that shows conditions to be perfectly normal in the tract, that fixed idea at least is removed, perhaps to be replaced by another.

Treatment.—The treatment must be directed to the general condi-

tion, based on hygienic principles, for the more it is directed to the intestinal tract the more irrational becomes the patient, until every act of his life is considered only from the standpoint of what effect it will have on his abdomen. Before the present method of x-ray work on the intestinal tract was attained, some of our patients were operated for suspected extensive adhesions, which could not be absolutely verified by physical examination. Rarely minor bands were found and separated, but the mental condition was never improved by such efforts, and usually, after a return from the hospital, the patient complained as bitterly as before of his disagreeable abdominal sensations.

INTESTINAL NEURALGIA.

Intestinal neuralgia differs from the preceding by either exacerbations of the dolorous sensations, at intervals, to actual excruciating pain, resembling spasmotic colic, or the attacks may spring up unexpectedly after a period of absolute well-being. The distinction from the spasm associated with stenosis or membranous colitis can be made only after close observation and examination of the stool. Enteralgia from plumbism is not always associated with retracted abdomen and obliteration of the lumen of the intestine from spasm, nor is the retention of the feces more than a temporary affair. In other words, lead colic may exist as a purely sensory disturbance, and is not necessarily confined to paroxysms, but may be constant, only of a lesser degree. It has been experimentally proven on animals that the seat of the pathologic change in this form is the great abdominal ganglion, and the results of some autopsies on persons dying from chronic lead poisoning have shown similar changes, but it has not by any means been proven that these always exist.

With the spasmotic enteralgia of tabes, which belongs to this class, however, the seat of the pathologic process is situated in the posterior roots of the spinal cord. Why these attacks occur, no one has been able to determine, and, according to A. Schmidt, they are sometimes accompanied by an excessive secretion of mucus, and, as already stated, occasionally with spasm. The gout of the abdomen, attacks of enteralgia due to the over-accumulation of uric acid in the system, described by the English, probably has no existence. Outside of the varieties mentioned, there is probably no true enteralgia. The spontaneous idiopathic form, sometimes described, apparently does not exist, and nothing can be more unsafe than to attribute sharp attacks of abdominal pain to enteralgia. The forms which occur after operation

are unquestionably dependent on adhesions or from scar tissue, involving the nerve endings, and not from the original disease for which the operation was undertaken, as claimed by some—a predilection of that part toward pain. Very often manipulations of the part under the fluoroscope screen will easily clear up the diagnosis. So frequently are these indistinct enteralgias confused with myalgias of the abdominal muscles, especially when the pain is increased by a long breath, bending, coughing, or sneezing, that a course of aspirin or some other anodyne is always advisable for diagnostic purposes.

Treatment.—The treatment is necessarily directed toward the cause of the attacks—lead poisoning or sclerosis of the cord. Of course the pain must be immediately relieved by a hypodermic of morphine, with hot applications to the abdomen, but from that point the ways separate. If the sclerosis arises from syphilis, specific treatment may be employed, including the newer salvarsan, but in our experience nothing has been able to check the attacks of pain until the disease is well advanced and marked paralytic symptoms appear, when they cease spontaneously. With the lead poisoning the outlook is brighter, and a free use of the iodides as well as a morning dose of magnesium sulphate usually checks the attacks. Those due to adhesions are also equally as discouraging, because, when freed by operation, they are apt to reform. In one case where the abdomen had been opened once to free adhesions and the pain returned, fibrolysin (thiosinamine and sodium salicylate) was injected, the contents of an ampule every other day, with relief, but whether it acted as an anesthetic or freed the adhesions was a doubtful matter; at least its general use for that purpose does not always produce such favorable results.

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